Roadmasters' Convention Number

OCTOBER, 1928

Railway Engineering and Maintenance

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered at Chicago, Ill., as second-class matter.

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Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

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Published on the last Thursday preceding the month of issue by the

Simmons-Boardman Publishing Company, 105 West Adams Street, Chicago, Ill.

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SAN FRANCISCO: 74 New Montgomery Street

Entered at the postoffice at Chicago, Ill., as mail matter of the second class.

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Subscription price in the United States, Canada and Mexico, $2.00 per year; foreign countries $3.00. Single copies, 35 cents.

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It demands widespread acceptance, recognized superiority. Fairmont has the largest number of cars in use... over half of all cars used... and more than all other makes combined.

These have made for Fairmont Leadership, for Fairmont Preference, the vital results of Performance and Satisfaction.

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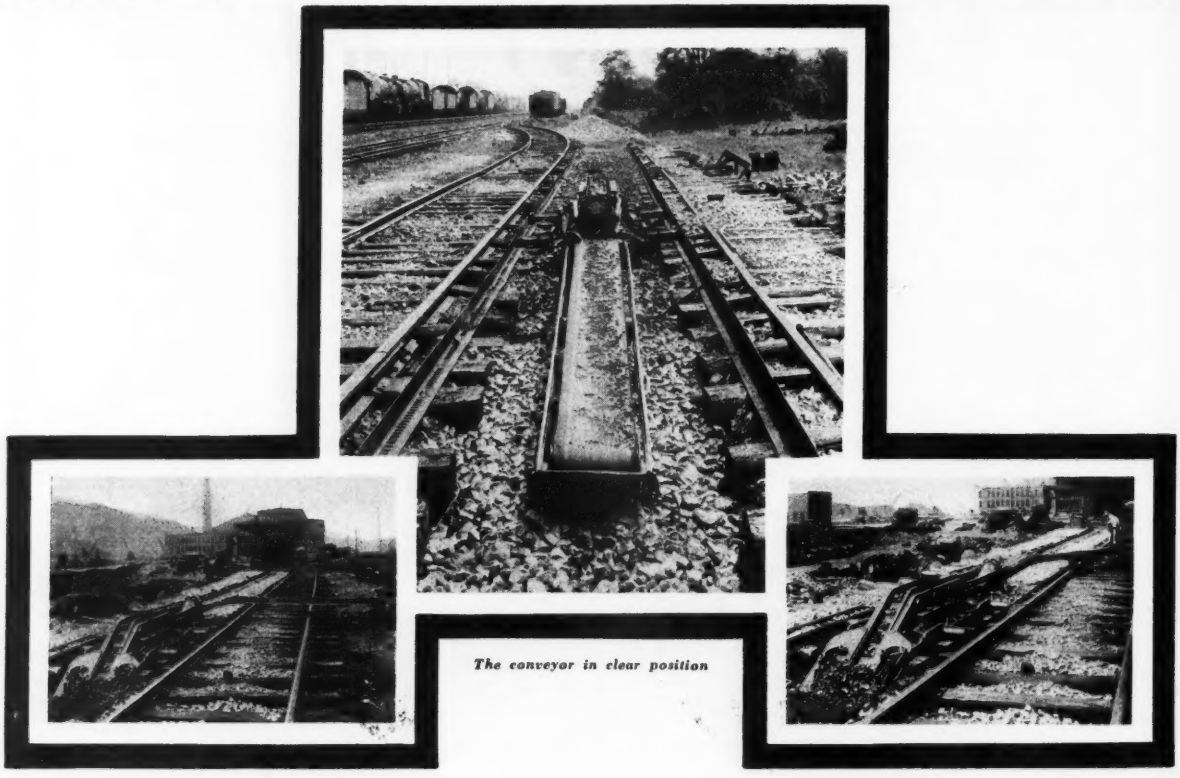
W O R L D K N O W S

In November

McWILLIAMS
BALLAST CLEANING DEVICES



Conveyor in operating position

The conveyor in clear position

Conveyor being swung to clear

A NEW SWING CONVEYOR

—has just been developed and perfected by this company for use with the McWilliams Mole.

This conveyor will deliver the dirt to either side of the track when desired and swing to the clear. It is no longer necessary for laborers to carry the dirt from the rear of the "Mole," and the amount of labor required to operate the "Mole" is therefore reduced at least fifty per cent.

Write for the facts

RAILWAY MAINTENANCE CORPORATION
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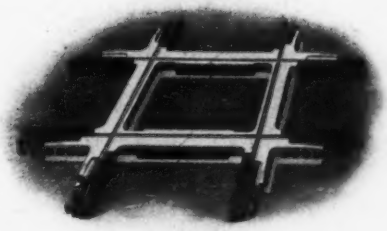
The Headquarters for

SOLID MANGANESE STEEL CROSSINGS



MORE THAN 98% GOOD CROSSINGS

Less than 2% of the last 1100 Solid Manganese Crossings shipped by us have had to be replaced due to cracks, faulty metal or other reasons.

This is a record of which to be proud and an excellent reason why your orders should be sent to us.

The same good tough ***TISCO*** Manganese Steel and the results of our many years' experience in designing proper structures are employed in all our Steam and Street Railway Special Trackwork.

Write to our District Offices for information about our latest Scientifically Designed Type—the peer of all—crossings.

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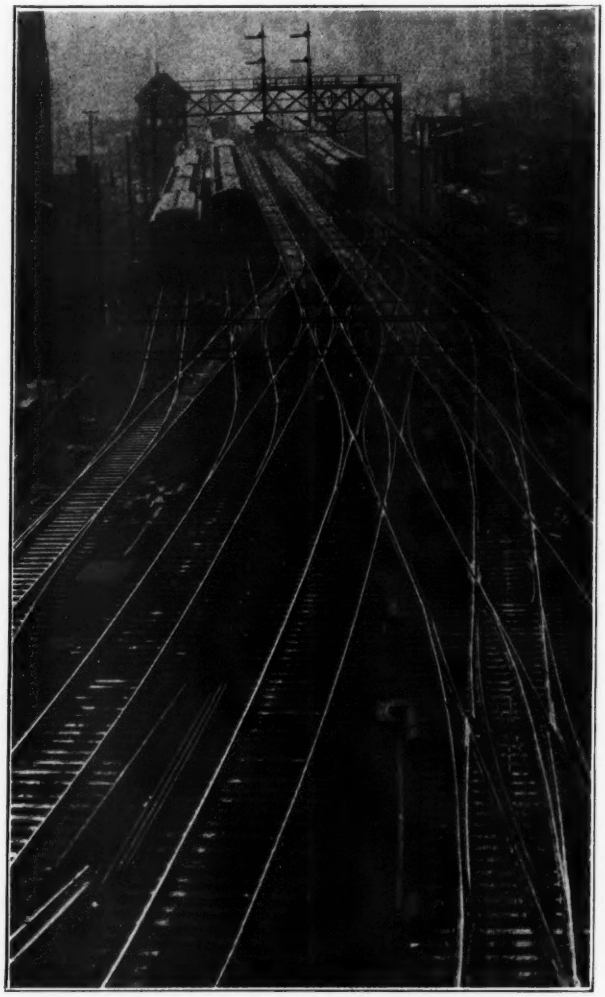
TISCO MANGANESE STEEL TRACKWORK



Manganese, the steel par excellence for Special Trackwork

Since its introduction by Wharton in steam railroad trackwork in 1900, Manganese Steelhas proved to be the metal par excellencefor this purpose.

The exceptional wear-resisting qualities of *Tisco*Manganese Steel imparts to Wharton Trackwork lasting qualities that are unmatchable.

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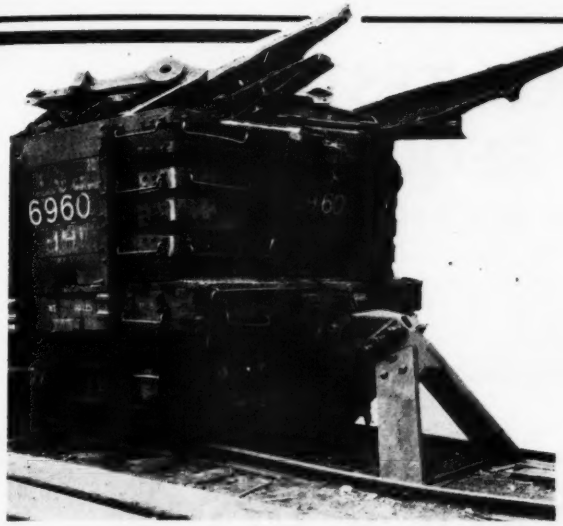


Always built for this one need of yours—

In the forty odd years that the Mechanical Mfg. Co. has built bumping posts for you, and other users and operators of railroads, every post has been designed and built on the assumption that what you and the other users wanted was to **stop** cars at a certain point.

"Mechanical" Posts have done it. That is attested to by the many great railroads that have standardized on them.

It is now generally conceded that that is what bumping posts are for.

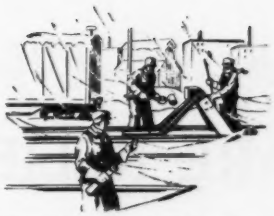
The latest of the "Mechanical" Posts is the

Improved DURABLE

built to stop even the new large-capacity, extra-heavy rolling stock. The illustration above shows an actual test where a DURABLE took a blow of 102,000,000 foot pounds without chipping a casting. Persons or property behind that post are as safe from harm as though miles away.

A DURABLE does what it was built to do; the maintenance of the post will always be low.

The cost of the post installed is low; and it takes only 3'-4" from face to extreme end of back braces. In other words, efficiency and economy are what sell the Durable.



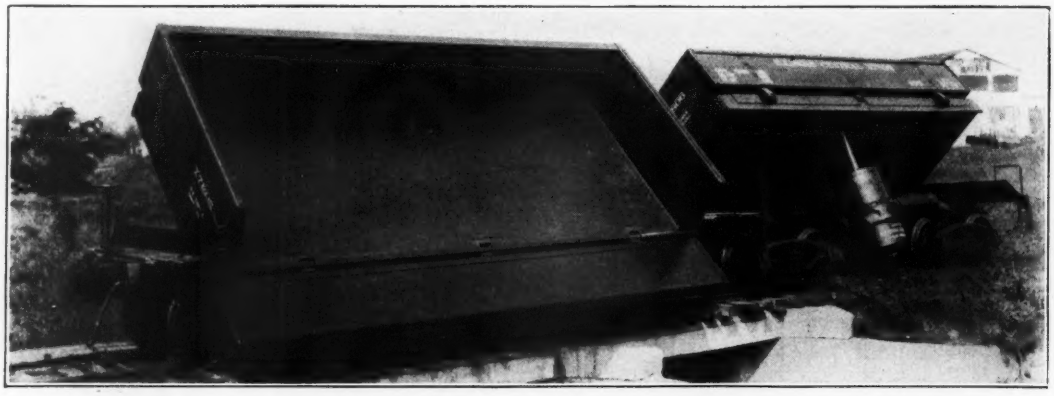
Whatever the weather, installing crews get Durables in quickly. All parts of the post matched and fitted at the factory and not a shovel-full of dirt to move.

The space at the track end that we save in the Durable has many a time let in an extra car at the switch end of a stub.

The Mechanical Manufacturing Co.

Union Stock Yards, Chicago, Illinois

MECHANICAL



Differential Cars dump both ways. The above photograph shows Differential 20 yard cars, one dumping in one direction and the other in the opposite direction. Differential Cars are made standard in 20, 30, and 50 cubic yard capacities.

UP-TO-DATE ROADS
FIGURE THE PROFIT OF MAINTENANCE

Double Fulcrum **DIFFERENTIAL** *Double Trunnion*

"AIR DUMP CARS"

WILL SAVE YOU MONEY ON ALL MAINTENANCE JOBS. THERE'S A PROFIT IN USING DIFFERENTIAL CARS AND THE MONEY YOU SAVE IS JUST AS GOOD AS THAT YOU EARN

Low Height—The double fulcrum principle allows the body to rest on four points directly over the bolster side bearings. In ditching or steam shovel work the ease of loading this low height car means a definite saving in money.

Clear Dumping—The double fulcrum principle plus the down-folding door casts the load well away from the track. "Keeping the dirt out of the ballast" means a great saving in money.

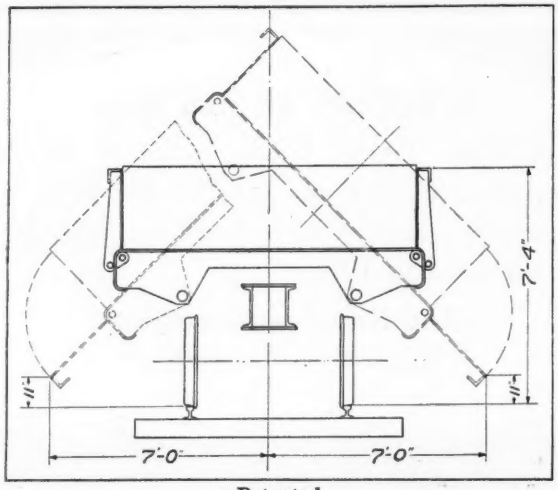
Stability—The Differential Car is as stable as a gondola. It can be hauled in train at high speeds with no danger of accident.

Construction—The Differential Car is constructed with such simplicity and ruggedness that long life and minimum maintenance are assured. The entire elimination of locking mechanism means the end of most dump car troubles. Money is saved directly by eliminating maintenance charges and indirectly by keeping the car in service every day.

Clear Opening—No obstruction to discharge of load. Car can dump anything steam shovel can load.

The Differential Car

has become synonymous with safety. In addition, its superior performance and its excellent construction make it a money saver in every department.

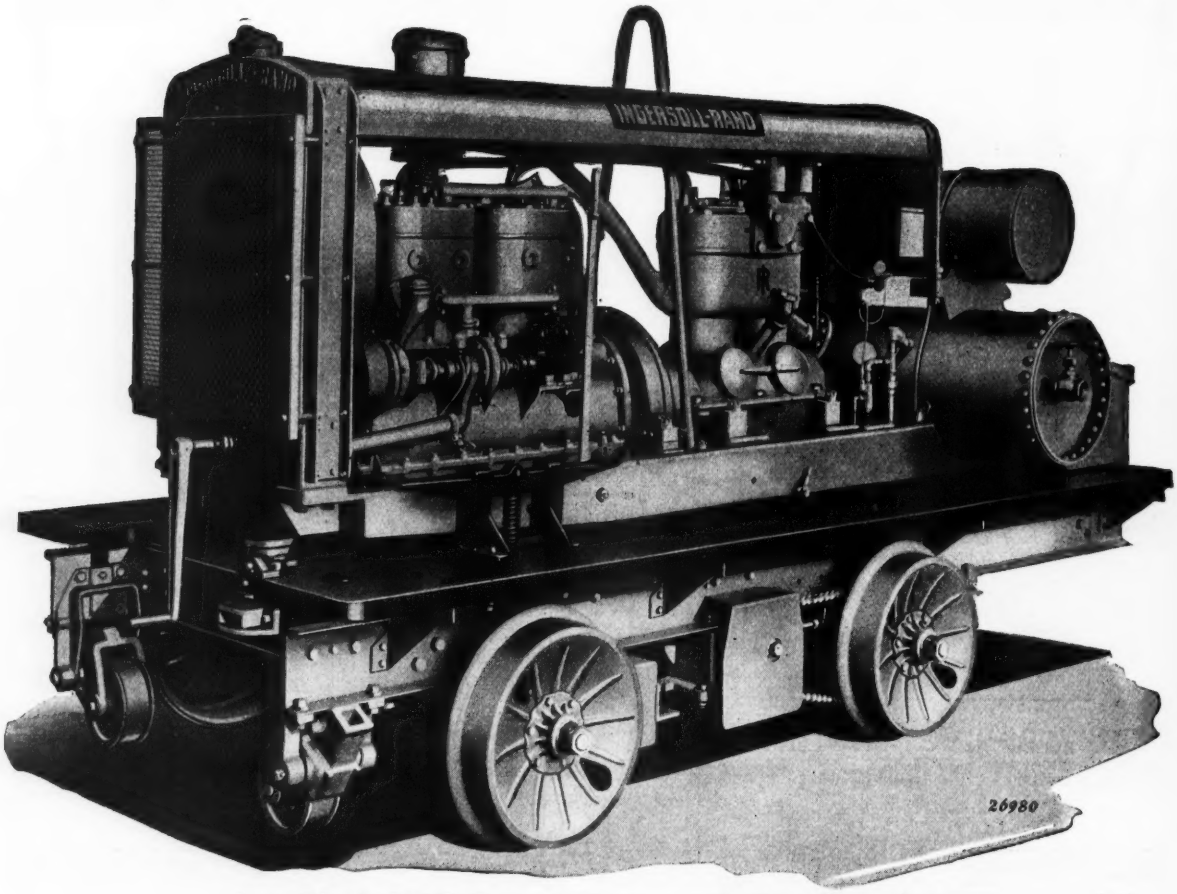


Patented

The Differential Car

is the most notable achievement in dump car design for many years. It combines excellence in every operating phase—and it eliminates the locking mechanism!

THE DIFFERENTIAL STEEL CAR CO.
FINDLAY, OHIO



Ingersoll-Rand 8 Tool Tie Tamper Air Compressor with self-propelling mechanism

Another Big Improvement In Railway Portable Compressors!

Ingersoll-Rand Self-Propelled Tie Tamper Compressors are now equipped with an air motor for driving the compressor car. The air motor is of the four-cylinder type, and the driving mechanism is a sprocket and chain arrangement direct from the air motor to the axle.

This drive gives a wider range of speed and better control. The air motor also serves as an auxiliary brake on descending grades. There are no gears to engage or strip—no clutch to get out of order.

Other features include: (1) swivel-type transverse wheels, which also serve as lifting jacks and eliminate the need for hydraulic, pneumatic, or other types of lifting jacks; (2) draw-bar connection on both ends of car for towing; (3) three-point mounting of compressor on railway car.

New features—improved design—better materials—all make Ingersoll-Rand Tie Tamper Compressors the most modern and economical machines for railway work. Ask for complete information.

Ingersoll-Rand Company is the pioneer in the development and introduction of labor-aiding compressed air equipment for railroad track construction and maintenance. By reason of its long experience, Ingersoll-Rand can offer a superior service—one which will help produce the best results with such equipment.

INGERSOLL-RAND COMPANY—11 BROADWAY, NEW YORK CITY

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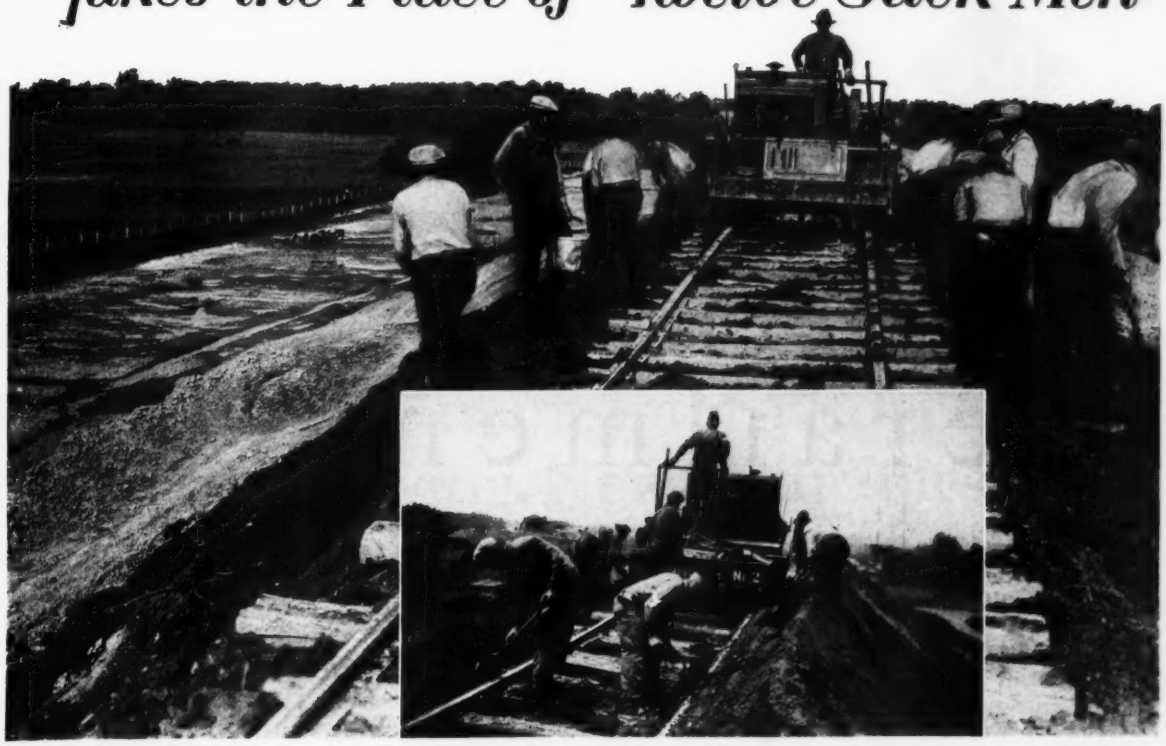
For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 10 Phillips Square, Montreal, Quebec

155-TT

Ingersoll-Rand

Takes the Place of Twelve Jack Men



3000 yards of fill disposed of per day with the aid of a Nordberg Track Machine

North of Milwaukee, John Marsch, Inc., is building a cut-off for the C. & N. W. Ry., in order to remove their tracks from the residential sections of Shorewood and Whitefish Bay. This involves the building of several miles of fill having a maximum height of 40 feet. The fill material is clay, good when dry but hard to handle when wet.

Two Nordberg Track Machines were used in raising this track, the above illustrations showing a standard gauge machine equipped with extra spuds for raising both rails at a time. A twelve car dump train carrying about 180 yards of fill is dumped at either side. The Track Machine then lifts the track 18 inches to 2 feet, filling is shoveled under the ties and the process repeated, disposing of the dumped material and rapidly raising the height of the fill.

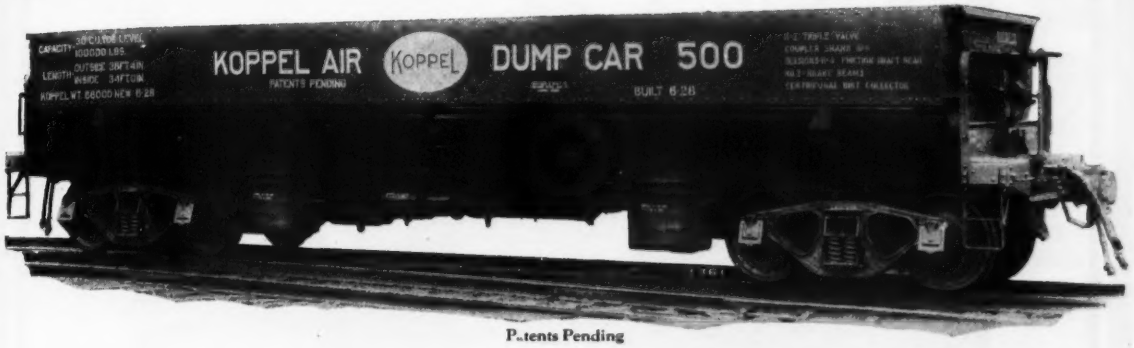
No jack gang is required on this raising job. The machine takes its place at a saving of $42.00 a day. It also eliminates the expense of making jack boards, which kept one man busy when the fill was wet. In addition to these savings, the machine greatly speeded up operations, a factor of vital importance to any contractor.

Wherever track must be shifted or raised, the Track Machine will show a labor saving of 50% of that required when hand methods are used. Write for Bulletin YE-8.

Nordberg Mfg. Co., Milwaukee, Wis.

THE NORDBERG PATENTED

TRACK MACHINE



Patents Pending

A Koppel Car of Improved Design Embodying New Principles

This ROLLING TRUNNION AUTOMATIC AIR DUMP CAR *Is Outstanding Because of These Characteristic Features:*

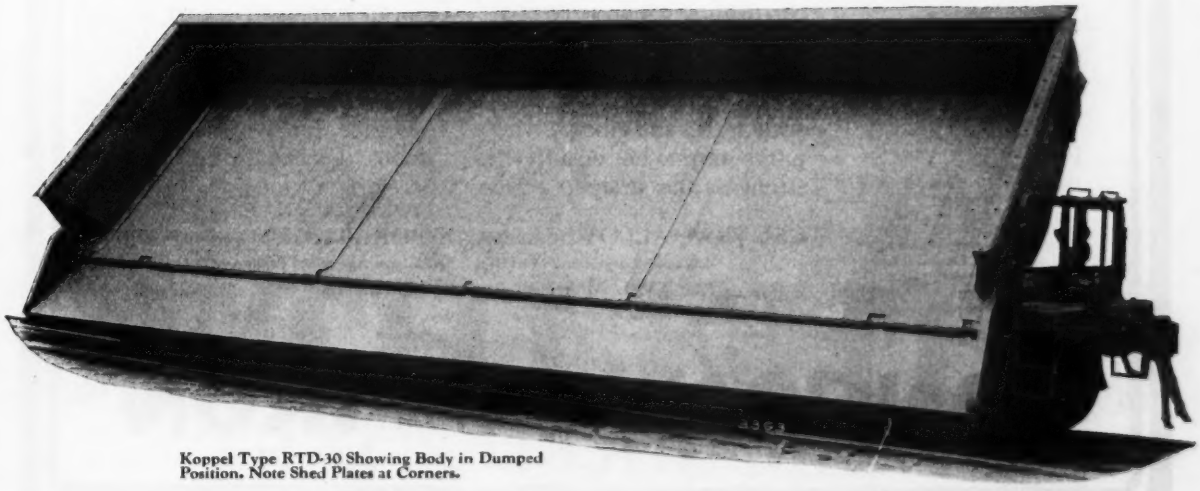
1. Low loading height, essential for ditcher service and advantageous for other operations.
2. Center of gravity is low, providing great stability on temporary or permanent tracks.
3. The load is carried in stable equilibrium directly on the center sills, bolsters and cross bearers and not on the trunnions at the side of the car.
4. An interlocking cast steel stop device prevents movement of body, both transverse and longitudinal.
5. Rapid discharge of lading, free from any shock to the car.
6. Dumping operation of any or all cars in a train can be controlled from any one car.
7. Shed plates at dumping corners prevent gathering of dirt.

H. E. CHILCOAT, Mgr. of Sales,
Air Dump Division

TRADE MARK REGISTERED
KOPPEL
U.S. PATENT OFFICE

Bulletin No. 59 describes the Type RTD Car in detail

KOPPEL INDUSTRIAL CAR AND EQUIPMENT COMPANY
KOPPEL, PENNSYLVANIA

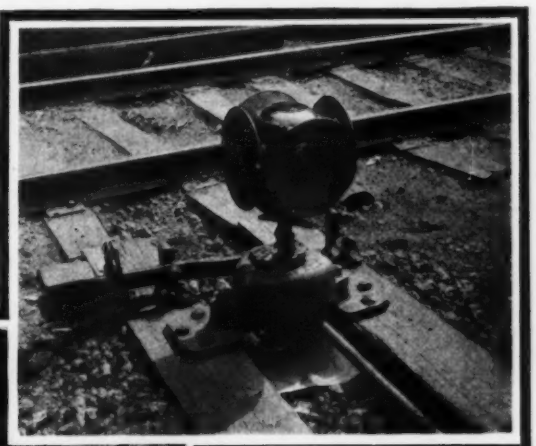


Koppel Type RTD-30 Showing Body in Dumped Position. Note Shed Plates at Corners.

3 LEADERS

The three products shown on this page are leaders in their respective fields and typify the complete line of Bethlehem Track Equipment. They are made of high grade materials, and are scientifically correct in design. They are easy to install, and have proved their dependability by long service on representative American railways.

Bethlehem Track Equipment embodies the results of more than fifty years' experience in the manufacture of track materials—as well as experience gained in maintaining a large amount of heavy duty track in Bethlehem properties.



New Century Switch Stand

The New Century is a low, parallel switch stand, positive when thrown by hand and latched; automatic when unlatched and trailed through. It is made in several models for use under the various conditions met with in high-speed main-line service.

(Shown at right)

Bethlehem Hook Flange Guard Rail

The Bethlehem Hook Flange Guard Rail is rolled from tough wear-resisting steel, and is properly designed to resist the shocks and strains of heavy traffic. It is shipped and installed as one piece. This guard rail is recommended for service in high-speed main lines and in yards.

(Shown below)

Bethlehem Gage Rod

Bethlehem Gage or Brace Rods hold track in correct alignment and distribute the lateral thrust of the wheels. The Gage Rod is a one-piece forging with a solid steel hook on one end and an adjustable clip on the other. It is made in two sizes for use with all weights of rails, and can be furnished insulated or non-insulated.

(Shown at left)

Other Bethlehem Railway Products

include: Bolts, Rolled Alloy Steel Crossings, Tie Rods, Machine Fitted Joints, Splice Bars, Rolled Steel Wheels, Abbot Base Plates, Hard Center Frogs, Tie Plates, Center Rib Base Plates, Forged Axles, Tee and Girder Rails, Hard Center Mates.

BETHLEHEM STEEL COMPANY

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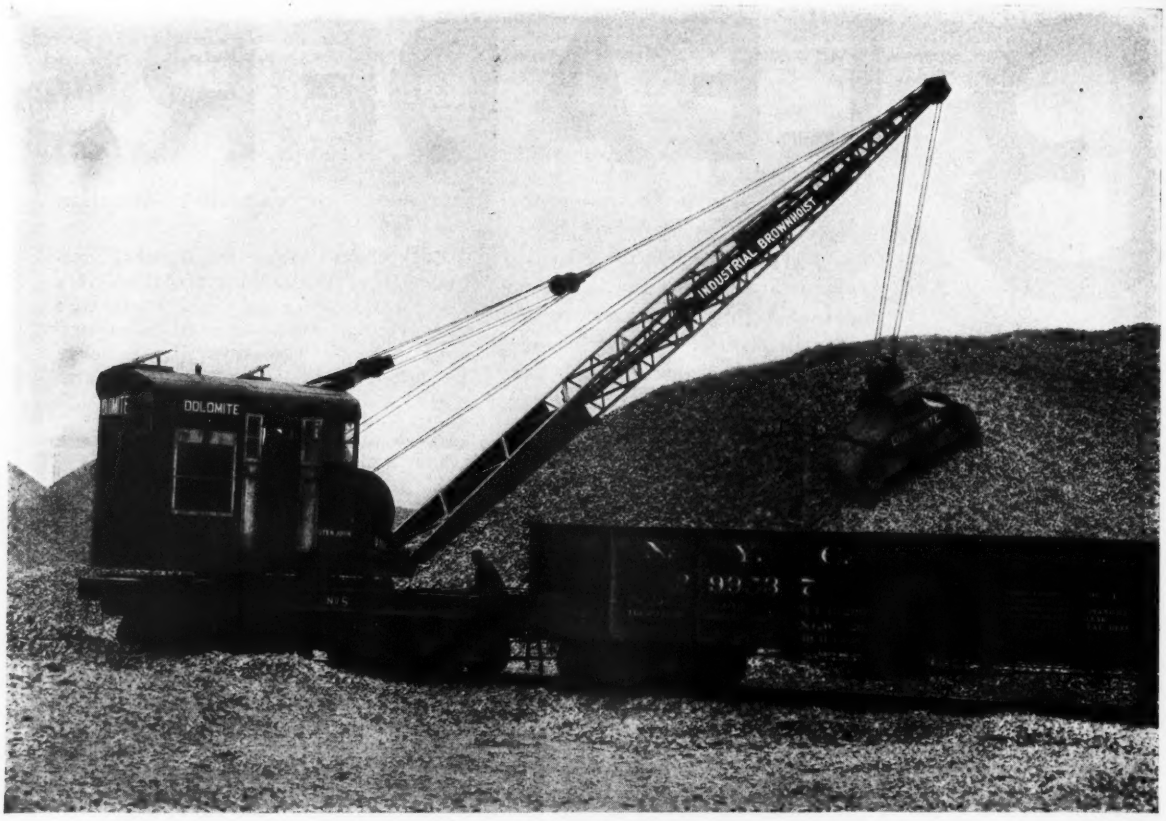
District Offices: New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh Buffalo Cleveland Detroit Cincinnati Chicago St. Louis San Francisco Los Angeles Seattle Portland Honolulu

Bethlehem Steel Export Corporation, New York City
Sole Exporter of our Commercial Products

BETHLEHEM
TRACK EQUIPMENT



25-ton capacity gas locomotive crane with 54-cu. ft. link-type bucket.

Dependable Gas Locomotive Cranes

INDUSTRIAL BROWNHOIST

Gasoline Locomotive Cranes 6, 7½, 10, 15, 25 tons Capacity

Gas Crawler Shovels

For several years Industrial Brownhoist has been building a complete line of gas operated locomotive cranes. The different types include cranes on 8 or 4-wheel railroad trucks as well as crawlers and capacities range from 6 to 25 tons.

Tested not only at the factory but also in the hands of owners, each of these machines has thoroughly proved its worth on all kinds of crane service. Gas cranes of today are fast operating as well as absolutely dependable; they are one-man operated and have the advantage of being ready to go to work at a moment's notice.

Our nearby representative knows the relative advantages of gas versus steam cranes on all kinds of handling work and will gladly give you the results of our experience. On many jobs the savings of gas operation would be well worth adding to your profits.

Industrial Brownhoist Corporation
General Offices: Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco.

INDUSTRIAL BROWNHOIST

What "railroad efficiency" means

EVER since the war the railroads have been steadily raising their standards of efficiency. Year after year, new records have been made in the various phases of operation and maintenance.

In 1927 the average number of cars per freight train was 46.4, and the average freight train load was 778 tons. In October, the average distance traveled per day by each active freight car was 39.5 miles, the largest mileage in history. It is estimated that the rapidity of freight transportation is now 30 to 40 per cent faster than at the close of the war. In the passenger service a new record was made when the average mileage per passenger locomotive per day reached 117.1 miles for the month of August. These are some of the important factors of efficiency in which new records were made last year.

By supplying up-to-the-minute oxwelding service to the railroads controlling a majority of the trackage in the country, the Oxweld Railroad Service Company has contributed its share to the high efficiency of modern railroading. 15 years of experience in this field have equipped it to work successfully with any railroad organization.

THE OXWELD RAILROAD SERVICE COMPANY

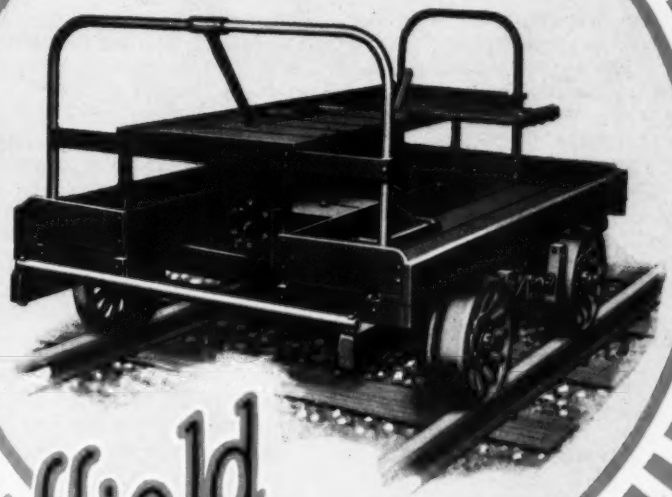
Unit of Union Carbide and Carbon Corporation

UCC

New York City: Carbide and Carbon Building
Chicago: Railway Exchange

OXWELD RAILROAD SERVICE

ANNOUNCING!



"Sheffield 44-B"

Creates a new advanced Standard!

Turn page for information on many new features

TIMKEN BEARING EQUIPPED

FAIRBANKS-MORSE

MOTOR CARS

FAIRBANKS-MORSE MOTOR CARS

FAIRBANKS-MORSE *Motor Cars*

"Sheffield Scores again!

The car

Just as all four-cylinder automobiles are not of the same quality—neither is this new Sheffield "44-B" to be considered as "just a one-cylinder section car." For in this new and improved "Sheffield" are found feature after feature which lift it above the ordinary conception of a one-cylinder car.

Put this car in the hands of a section crew. It may not be the cheapest car *in first cost* that you can give them—*but it will be the most economical over a period of years!*

Balanced nicely so that it can easily be taken on and off the rails—big, roomy tool deck and seats to take the gang and their tools to work and an engine and transmission that will get them there without fail.

New safety body

A larger, new safety body whose lower deck provides *22 square feet* of tool space—73½ inches between end boards, 5 inches in depth. This improved body adequately protects occupant's feet from the wheels. A glance at the illustration will show that toe-boards are automatically provided.

The front safety rail is the full width of the car. The rear rail is the full width of the seat—adequate protection with easy access to seats. The body is mounted on the *pressed* steel frame and can be removed in less than 60 seconds and lifted by two men.

The engine

Experiments and tests over a period of years have developed the engine in the new "44-B." An air-cooled head which decreases water consumption by 20 per cent at full load is furnished as standard equipment—the conventional water-cooled head will be furnished if desired. The piston is of the two-piece type with white metal top—more power and better cooling. A highly developed throttle valve and port arrangement gives smooth control of engine speed under all load conditions. The crankshaft is mounted on Timken Roller Bearings—proved so satisfactory on other Sheffield cars during the past four years. The combustion chamber is *entirely machined*—materially reducing carbon formation.

The clutch is the same impossible-to-burn-out type employed only on the Sheffield Car!

Get the data

Write today for full information. Learn why the lower operating and costs on this car make it the cheapest-in-the-long-run one-cylinder car you can buy.

Motor Cars
Trailers
Velocipedes
Push Cars
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Tank Fixtures
Motors
Scales
Diesel Engines

FAIRBANKS, MORSE & CO., 900 S. Wabash Ave., *Chicago, U.S.A.*
Branches and Service Stations Covering Every State in the Union

FAIRBANKS-MORSE

MOTOR CARS

A new light Crane

THE Buckeye *Utility* Crane, a favorite in the municipal field, has now been adapted to railway requirements. Speedy in every operation, exceptionally easily handled and maintained with a flexibility that adapts it to a multitude of jobs, it fits in where heavier, more expensive cranes are hardly practical or profitable. A heavy-duty industrial-type gasoline motor provides ample power and makes it strictly one-man operation. Full-revolving, it will work in any direction. It can be quickly moved under its own power or run to sidings to clear trains. Car truck mounting permits operation from the track or from rails laid on a flatcar. Alligator (crawler) traction is also available for other operations independent of track. Maximum production of one standardized model permits the low quotation of $4800.00 f.o.b. factory with complete steel cab and car truck mounting.

for over thirty years

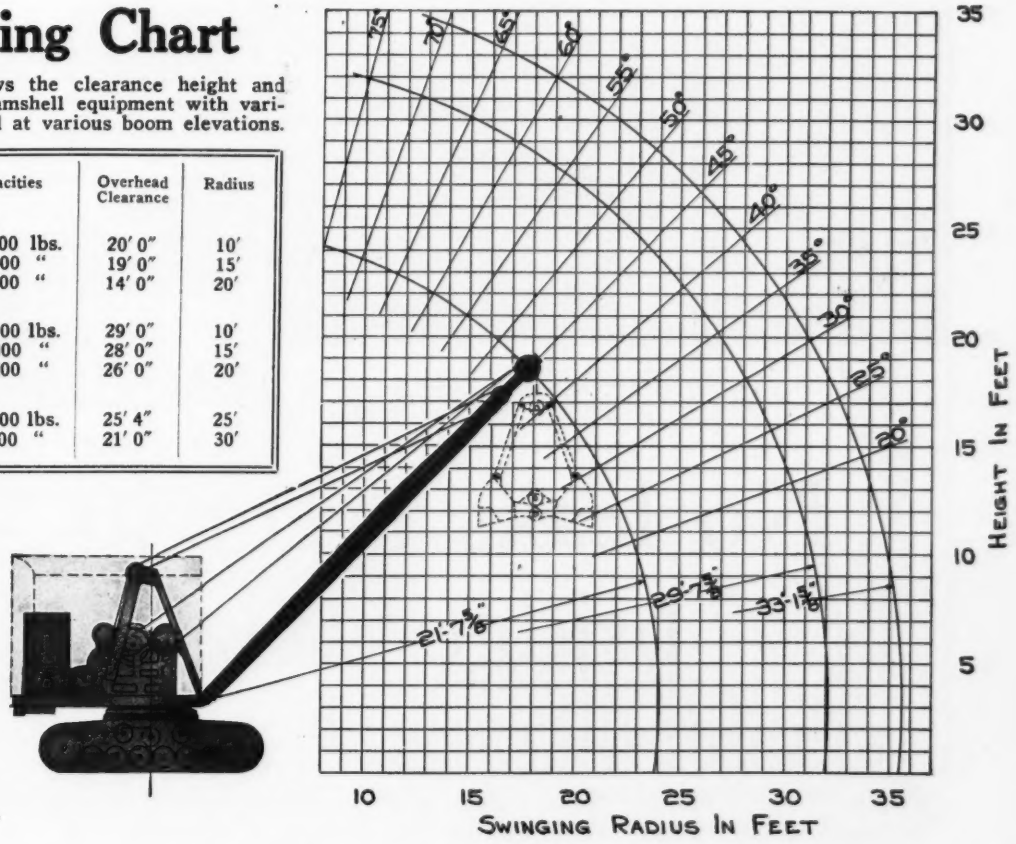
Buckeye

for Railway use!

Operating Chart

This drawing shows the clearance height and working radius of clamshell equipment with various boom lengths and at various boom elevations.

Normal Lifting Load Capacities	Overhead Clearance	Radius
With 21′ 6″ Boom		
7,000 lbs.	20′ 0″	10′
5,500 "	19′ 0″	15′
4,000 "	14′ 0″	20′
With 29′ 6″ Boom		
7,000 lbs.	29′ 0″	10′
5,000 "	28′ 0″	15′
3,200 "	26′ 0″	20′
With 33′ Boom		
2,400 lbs.	25′ 4″	25′
1,800 "	21′ 0″	30′



It can be used profitably, on some job or other, *every day in the year.*

Following are a few specific operations for which this Buckeye is advantageous and profitable:

1—Laying rail, including the unloading of new rail from cars onto the ground and the loading of old rail after it is released from the tracks.

2—Handling boxes, skips or clamshell buckets in service incident to the cleaning of stone ballast.

3—Handling the large variety of small excavation work, including its adaptability to the operation of clamshell, dragline, and orangepeel buckets within its capacity.

4—Handling heavy units such as frogs, switches, culvert pipe, etc., from cars to point of use.

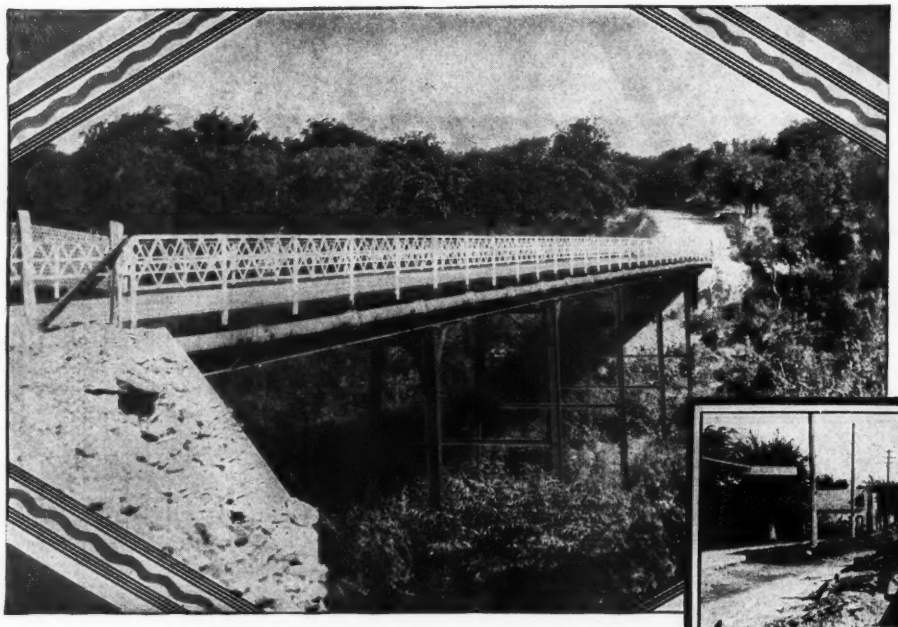
5—Transfer of locomotive cinders from ash pits to cars for removal, transfer of coal from cars to locomotive tenders and from cars to storage piles and the reverse, the unloading of engine sand into sand houses, etc.

6—Unloading of concrete materials such as sand and crushed stone from cars to storage piles at the construction site.

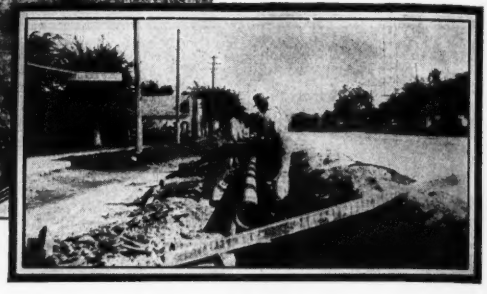
THE BUCKEYE TRACTION DITCHER CO.
Findlay, Ohio

There's a Buckeye Sales and Service Office near You

Utility Crane



Eight-inch Anthony Joint deLavaud gas pipe line suspended on bridge across Colorado River at Austin, Texas

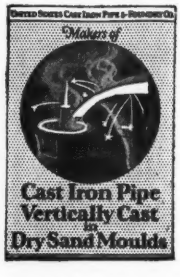


To reduce installation costs Anthony joint pipe is available in 24-ft. lengths made up of two standard lengths welded and tested under ideal conditions at our plant

No leaks occur in *this* bridge crossing

EACH year there is added proof of the soundness of deLavaud cast iron pipe with the Anthony joint for gas and water service. The Austin Gas Co. installed the 8 in. deLavaud main illustrated above in 1926. Where this line crosses the Colorado River Bridge, conditions are unusually severe, due to peculiar strain and constant vibration. That leakage has never developed is practical evidence of the great tensile strength of deLavaud pipe and the flexibility of the Anthony joint.

In modern high-pressure gas lines this type of installation has proved widely satisfactory. Under daily pressures of 90 to 125 lbs. leakage can be practically eliminated. DeLavaud pipe gives pressure-proof tightness, combined with ease of installation, and the age-defying economy of good cast iron.

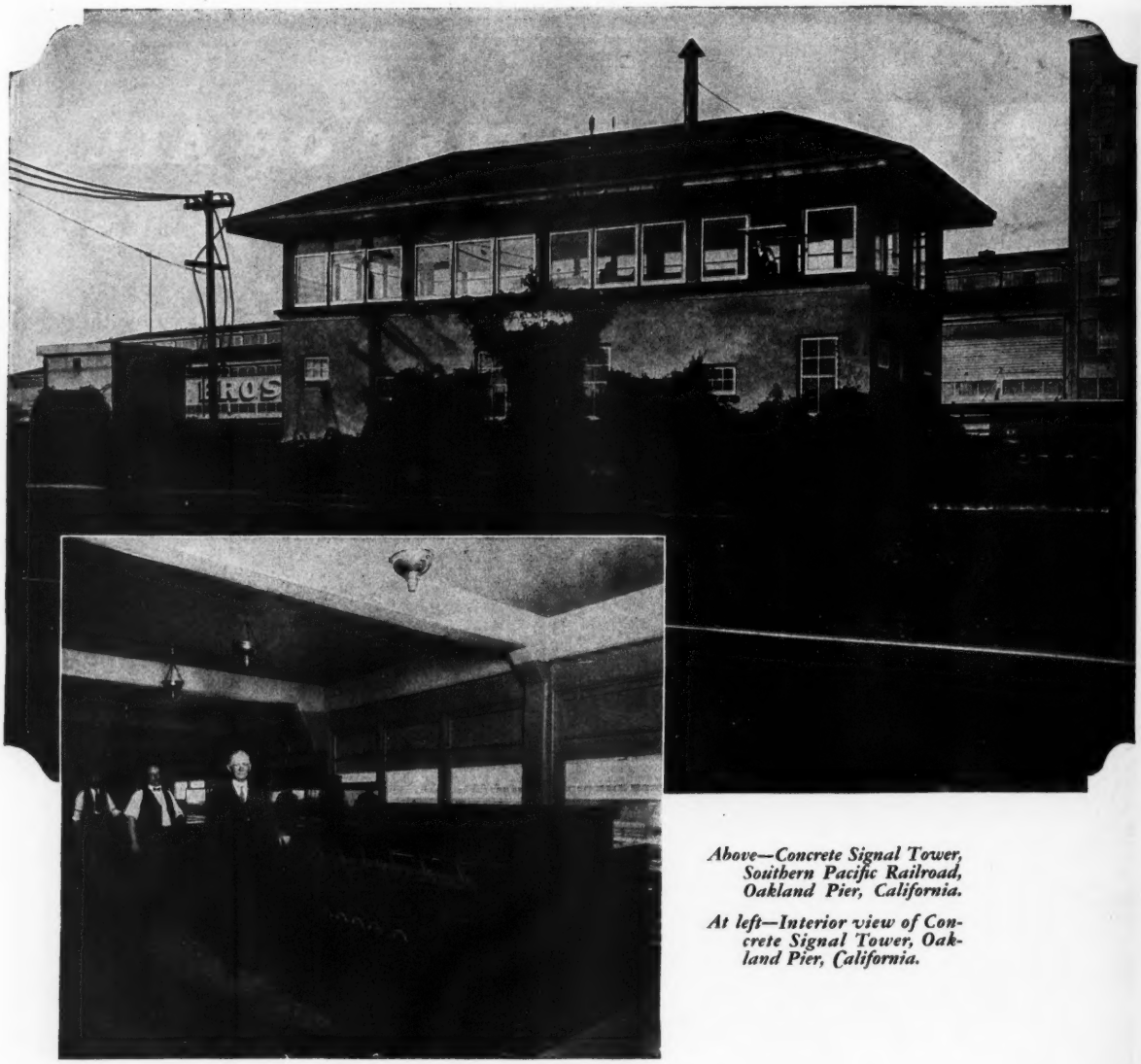


MAY WE SEND YOU LITERATURE COVERING USES and LATEST SPECIFICATIONS OF DeLAVAUD CENTRIFUGAL PIPE

United States Cast Iron Pipe and Foundry Company

General Offices:
Burlington, New Jersey

Philadelphia: 1421 Chestnut St.
Chicago: 122 So. Michigan Blvd.
Birmingham: 1st Ave. & 20th St.
Buffalo: 957 East Ferry Street
Cleveland: 1150 East 26th Street
New York: 71 Broadway
San Francisco: 3rd & Market Sts.
Los Angeles: 403 So. Hill St.
Pittsburgh: 6th & Smithfield Sts.
Dallas: Akard & Commerce Sts.
Kansas City: 13th & Locust Sts.
Seattle: 1st & Marion Sts.
Minneapolis: 6th Street & Hennepin Avenue



Above—Concrete Signal Tower, Southern Pacific Railroad, Oakland Pier, California.

At left—Interior view of Concrete Signal Tower, Oakland Pier, California.

To Guard Life and Property

RAILROAD OFFICIALS realize the folly of gambling with the safety of life and property. They insist upon the most efficient traffic control systems that human ingenuity can devise.

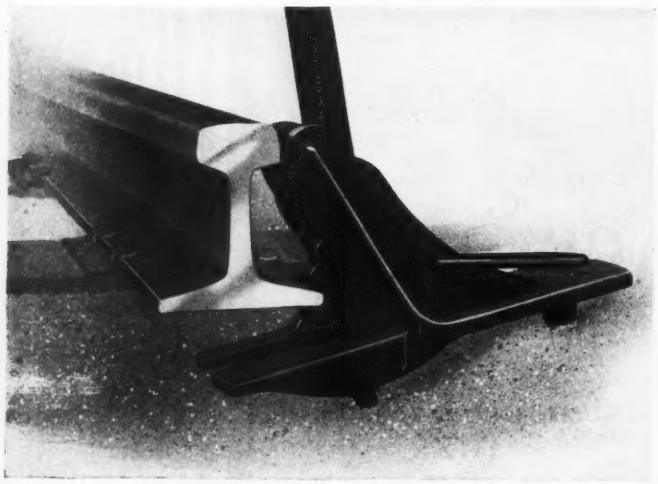
Signal towers of *portland cement concrete*—durable, fire-safe and economical—offer the *utmost* protection to the control equipment upon which safety and continuous operation depend.

PORTLAND CEMENT *Association*

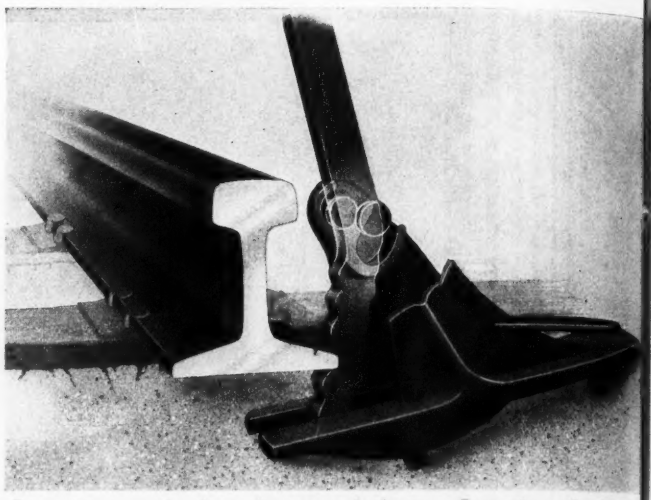
Concrete for Permanence CHICAGO

Hackmann Combination Track Liner

Consisting of a Base and a Bar. You Can Have Your Choice of Either a Lining or Tamping Bar



Proper position for setting Hackmann Track Liners. Set base against track at angle of about 45 degrees. Set bar in lower notch for first throw.



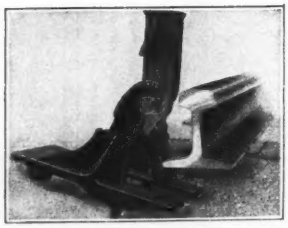
Do not move the base for second throw. Just place the bar in upper notch and in this way track will be pushed over and not lifted out of ballast.

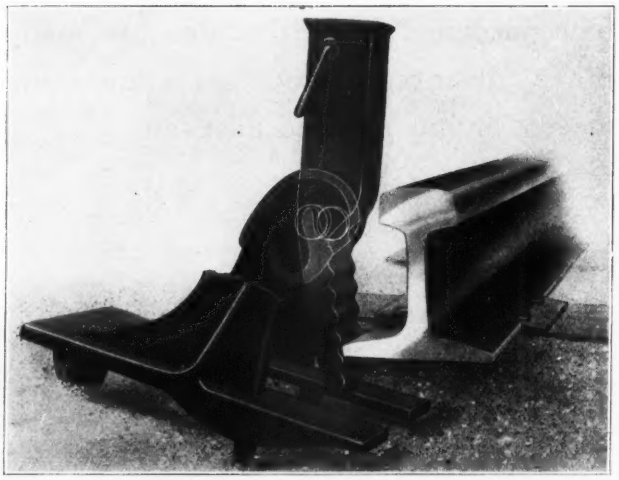
Hackmann Combination Track Liner used with either Hackmann Combination lining or tamping bar. Base can be left in track without interference to traffic.

Hackmann Duplex Track Liner

Consisting of a Base and Removable Fulcrum. Used with any Lining Bar.

NOTE THE TWO STEP FEATURE AT TOP OF BASE





HACKMANN DUPLEX TRACK LINER

You Can Make at Least Two Pulls Without Resetting the Liner

MADE OF TWO PARTS—A TWO-STEP BASE AND REMOVABLE FULCRUM

Hackmann Duplex Track Liner used with any lining bar. Fulcrum can be removed instantly and base left in track without interference to traffic

Hackmann Railway Supply Company

723 South Wells Street, Chicago, U. S. A.

SALES REPRESENTATIVES

DU-WEL STEEL PRODUCTS CO.
Railway Exchange Bldg.
CHICAGO

BALDWIN LOCOMOTIVE WORKS
Foreign Representatives
Philadelphia, Pa.

THE HOLDEN CO., LTD., Canada
Montreal, Toronto, Winnipeg
Vancouver

THOS. D. CROWLEY
Peoples Gas Building

Many company officials, purchasing agents, engineers and others who either buy fence or inspect and approve it after installation, are unfamiliar with important points of difference in chain link fence and its erection.

If all goes well, they may not care. But what if it turns out to be an inferior fence? What if top rails droop, gates sag, posts get "tipsy" and the entire fence takes on a degenerate appearance, and becomes so much junk in a few short years?

A COSTLY EXPERIENCE THAT CAN BE AVOIDED

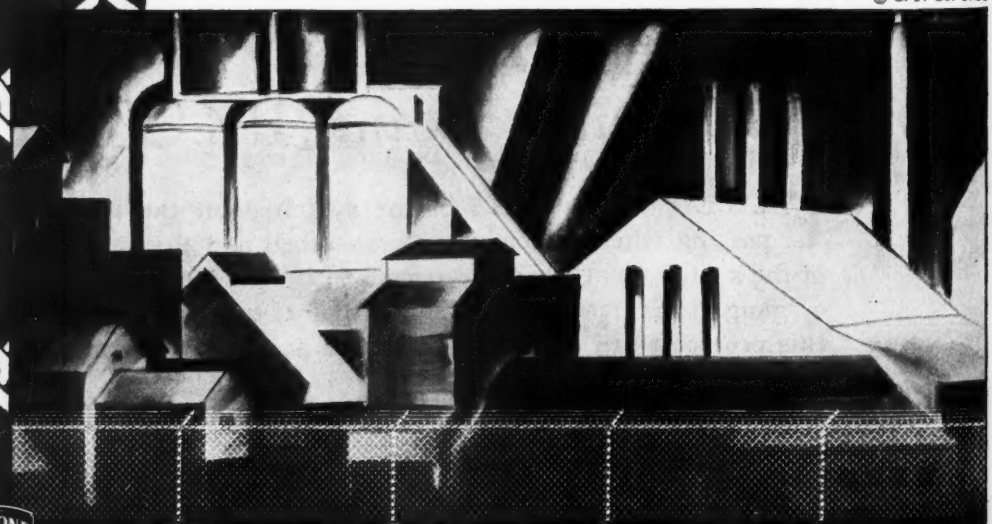
Such experience is costly. But it can be avoided. Not, however, by merely comparing specifications and prices. What do they tell you, for example, about strength and fit of fittings or design of gates? And what of samples? They tell you nothing about fence erection.

Yet you need not gamble with your fence dollars. You can *make sure* of high-grade materials and first-class erection, resulting in low annual cost of fence protection in the long run.

Call a Cyclone Fence Specialist. Cyclone occupies a unique position in the fence field. Cyclone has built up a national organization providing a complete, specialized fence service in every locality — every detail in strict adherence to the acknowledged high standards of this company. When you purchase Cyclone Fence, you get a Cyclone job from start to finish —fence built in the factory and erected on the job by *one* organization which takes Complete Responsibility without equivocation.

Call a Cyclone fence specialist and get a thorough understanding of fence in relation to your requirements. Know the difference in chain link fence. Before you award a contract, look for the Cyclone telephone number in the classified section of your local telephone directory, or write to nearest Cyclone offices.

Fencing for factories, schools, playgrounds, residences, estates, property of all kinds.



Cyclone Fence

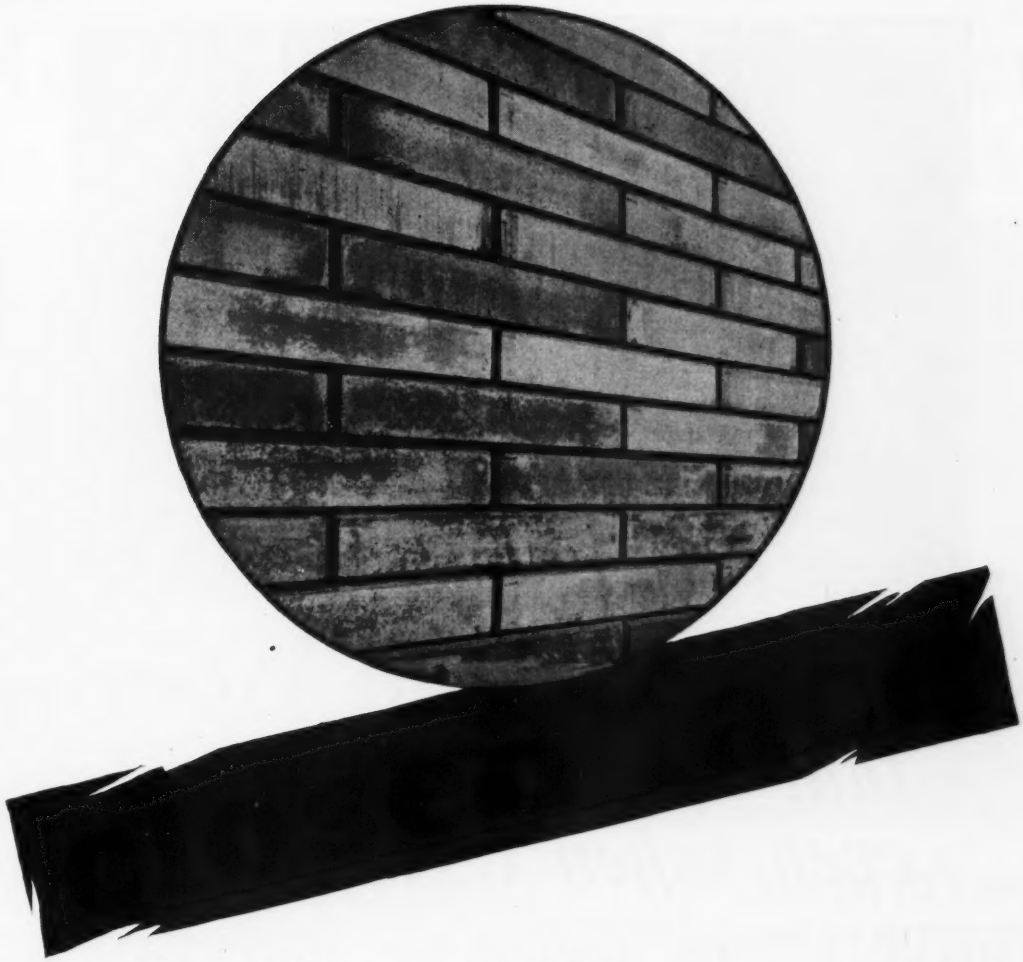
REG. U.S. PAT. OFF.

CYCLONE FENCE COMPANY :: *Main Offices: Waukegan, Illinois*

Works and Offices: North Chicago, Ill., Greensburg, Ind., Cleveland, Ohio, Newark, N. J., Fort Worth, Texas, Tecumseh, Mich., Oakland, Calif., Portland, Ore.

Direct Factory Branches in All Principal Cities

Pacific Coast Division: Standard Fence Company, Oakland, Los Angeles and San Francisco, Calif., Portland, Oregon and Seattle, Washington.



—and at low cost!

Why not make any retaining wall you build an *attractive* one? Federal closed face cribbing gives you a wall of striking appearance like fine masonry, with no projecting headers and no large openings for back-fill to filter through or vegetation to take growth. There is no maintenance whatever on a Federal wall.

Yet beauty and no-maintenance are but *part* of the story. The 2-unit construction is low in cost—saves both material and labor erecting—gives great structural strength and stability—allows speedy erection in any weather. There is 100% salvage if the wall is relocated. Write for booklet—no obligation.

Note the Y-shaped headers which interlock with the stretchers, holding the backfill without the use of a third member in the bank. This results in a cellular wall of great strength and with no plane of cleavage.

FEDERAL CEMENT TILE COMPANY
608 South Dearborn Street, Chicago
FOR OVER A QUARTER CENTURY

FEDERAL 2 piece Concrete CRIBBING

A Two-Fisted Wood
—*that fights rain and rot even when* UNPAINTED

TIDEWATER Red Cypress is so durable that you need not paint it. For better appearance and even greater durability, paint is, of course, desirable. But it is not essential.

Wherever upkeep must be cut to the bone (and where doesn't it have to be cut?), use this Wood Eternal. Put it to work on every structure that is exposed to the weather.

Grown in water, Tidewater Red Cypress resists water. Fortified naturally by "cypressene," it fights off rot. No wonder, then, that it is being used more and more each year by railroads... When you order this lumber, be sure to specify "heart grade Tidewater Red Cypress"—for outstanding durability is found only in the "coastal type" red cypress that grows near the Gulf and South Atlantic Seaboard.

Complete information on this long-lived wood will be sent free of charge in the booklet, "Money Saved for Builders." Send for it today. Southern Cypress Manufacturers Association, Dpt. RE-10, Jacksonville, Florida.

Tidewater Red Cypress is especially adapted for

Passenger Station Construction

Freight Sheds and Warehouses

Platform Construction

Conduits for signalling systems

Water Tanks—Box Cars —Cattle Cars—Refrigerator Cars

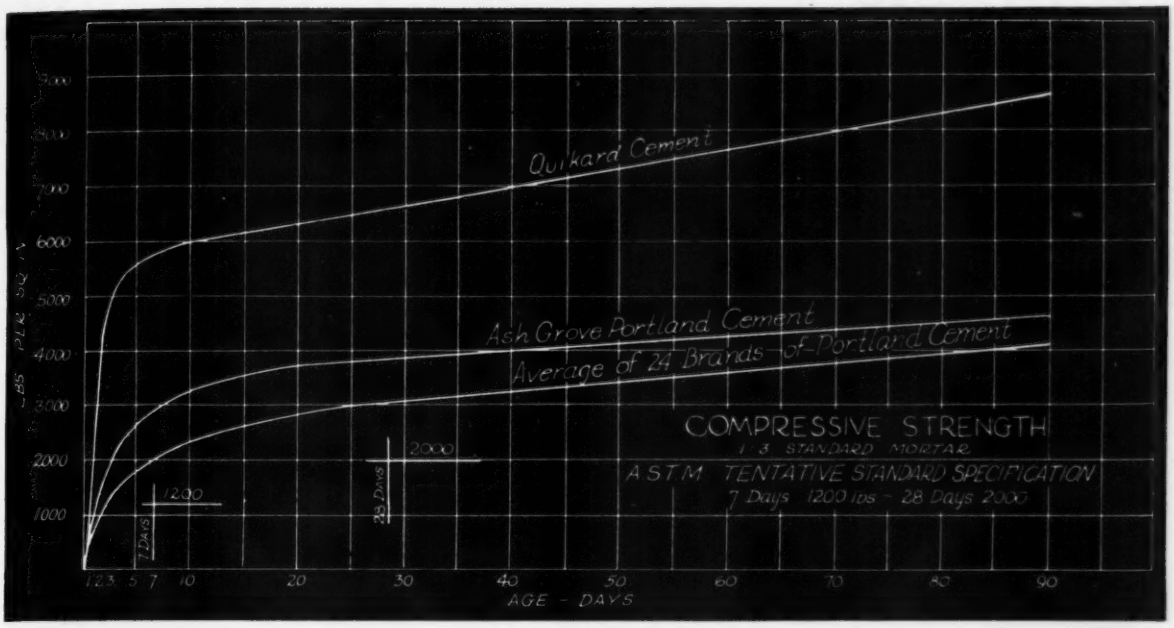
Yard Fencing

In short, any use where long life and absolute freedom from repairs are essential.

Specify TIDEWATER RED CYPRESS

THE WOOD ETERNAL

Meets *Every* Requirement for *Rapid* Concrete Construction



Standard Mixes . . . No Admixtures and 28-Day Strength in 24 Hours!

No other cement possesses *all* the practical advantages combined in Quikard—a *true* Portland Cement that produces 28-day standard strength in 24 hours!

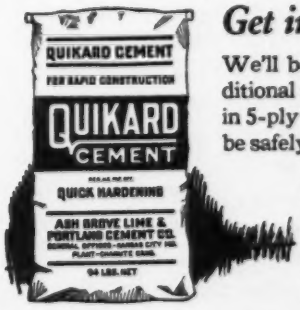
It sets normally, works easily, finishes quickly. It requires *less* and holds *more* water than ordinary cement—eliminating expansion and contraction cracks, shrinkage and drying checks. It makes a light gray, watertight concrete that requires curing *only* 24 hours!

Turntable bases, crossings, freight-house pavements, bridges and culverts, made with Quikard concrete, can be safely used in 24 hours. Maintenance and construction gangs can move along to next job two to three weeks' sooner.

Made only by the Ash Grove Company, Quikard Cement is backed by this manufacturer's reputation for highest quality and unquestionable dependability, extending over nearly half a century!

Produced Only by
ASH GROVE LIME & PORTLAND CEMENT CO.
Founded in 1882
Grand Avenue Temple, KANSAS CITY, MO.

QUIKARD CEMENT

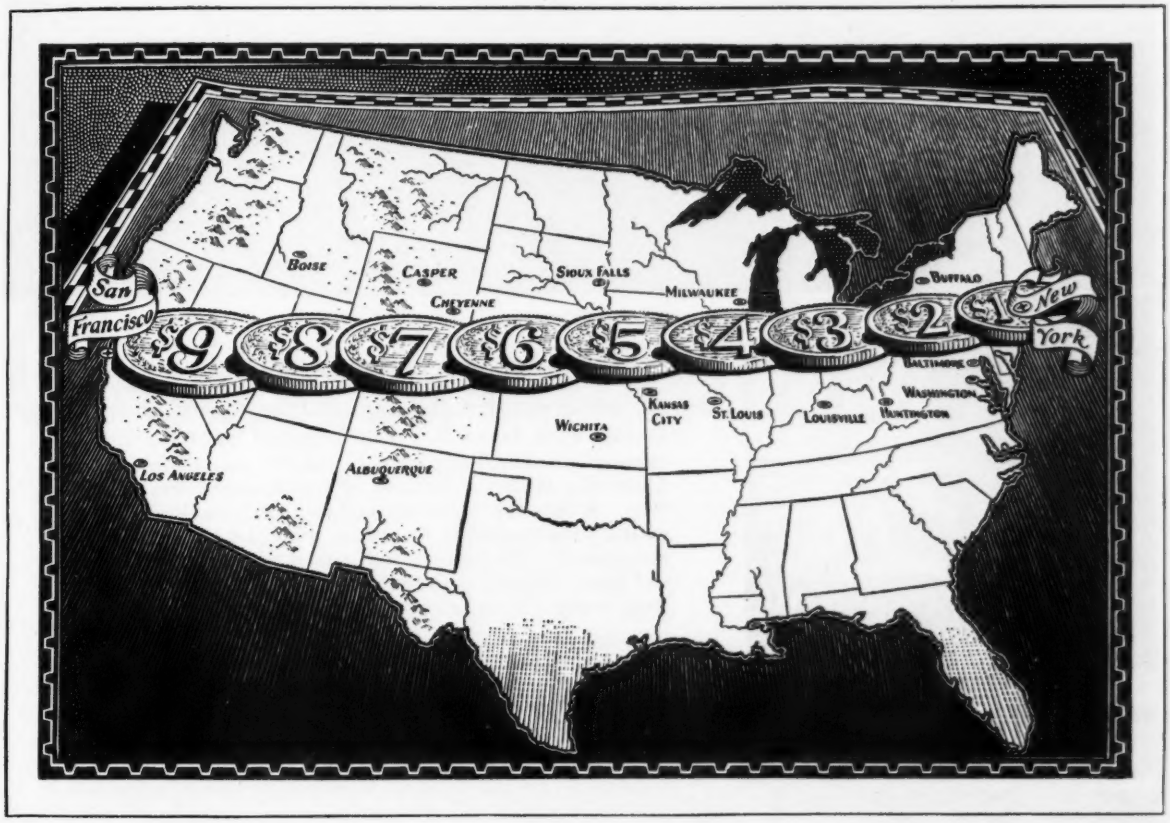


Get in touch with us—

We'll be glad to forward any additional data you require. Packed in 5-ply paper bags, Quikard may be safely stocked for emergencies. Shipped in mixed cars with Ash Grove Portland Cement. Whether you are in the market now or not, write, wire or phone us *today*, so you will have Quikard when you *need* it!

A *TRUE* PORTLAND CEMENT

How Cheaply you can "Travel" by Telephone



An Advertisement for Bell Long Distance Telephone Service

UNDER the latest station to station day rates, you can now "travel" the thousands of miles to a point across the continent and return by telephone for only $9.00. From Dallas to New Orleans and return for only $2.20. From Detroit to Chicago and back for only $1.35. From San Diego to Mexico City and return for only $10.50.

A Chicago business man recently had to endeavor to close negotiations with 30 concerns in 12 cities. Preliminary work had been done, but personal contact was necessary. In one day, he saved 5000 miles of physical travel and at least ten days' time from his office. He made four long distance calls to New York. Two to Buffalo. One to Syracuse. One to Covington, Va. Six to Pittsburgh. Five to Cleveland. One to Louisville. Two to St. Louis. Two to Kansas City. Two to St. Paul. Three to Milwaukee and one to New Orleans.

His negotiations were successful in 60% of the calls. "In many cases," says this man, "the long distance telephone call is actually superior to a personal call. It gets an immediate audience."

The president of a large Philadelphia rubber company has each one of his salesmen call him at the end of the day. Often large sales that a man is about to give up as hopeless are saved by the suggestions received from his president by Long Distance.

What distant trips could you profitably make today by telephone? . . . *Number, please?*

A Partial List of Railroads using
UNIVERSAL PIPE

PENNSYLVANIA LINES
FLORIDA EAST COAST
NEW YORK, NEW HAVEN & HARTFORD
CHICAGO, BURLINGTON AND QUINCY
LONG ISLAND
DELAWARE, LACKAWANNA & WESTERN
MOBILE & OHIO
CANADIAN PACIFIC RAILWAY
BOSTON & ALBANY
BOSTON & MAINE
CENTRAL VERMONT
CHICAGO AND NORTHWESTERN
LOUISVILLE & NASHVILLE
WHEELING & LAKE ERIE
INTERNATIONAL RAILWAYS OF CENTRAL AMERICA
TRUXILLO R. R. OF HONDURAS
TELA R. R. OF HONDURAS

Eleven Years of Service As Good as New

This 8-inch Universal Pipe water supply line at Remount, Texas, laid eleven years ago, continues to give dependable uninterrupted service.

Nothing to deteriorate, nothing to work loose.

Wrenches the only tools needed to make these tight, flexible, iron-to-iron joints.

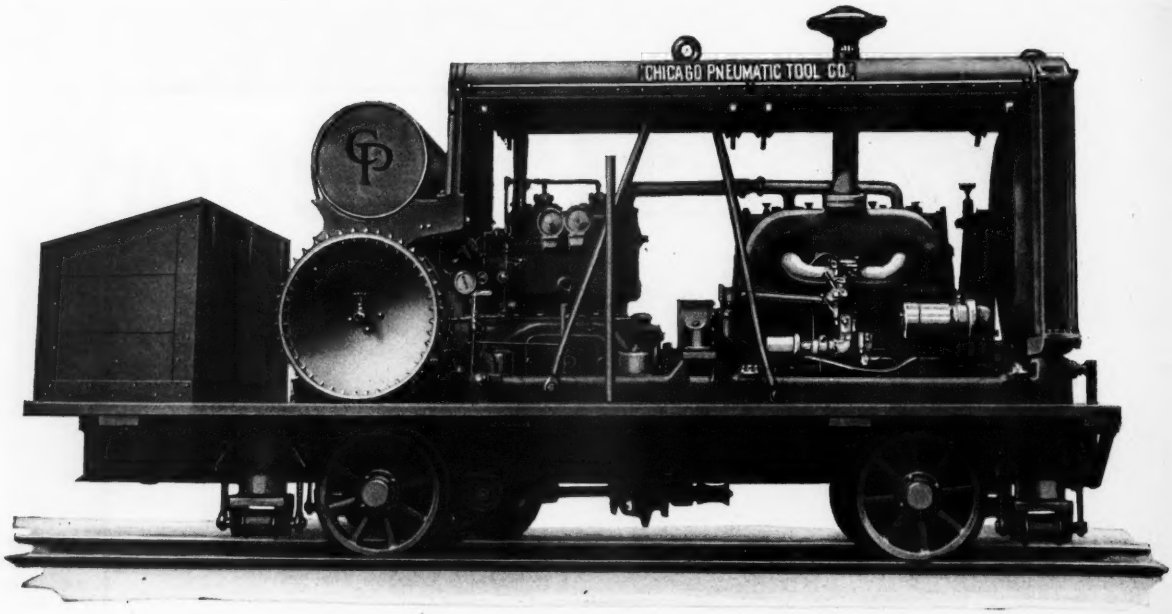
The contact surfaces of the hub and spigot ends are machined on a slight differential taper making a natural iron-to-iron joint that amply provides for expansion and contraction, vibration and uneven ground settlement.

Approved by the Underwriters Laboratories which are under the direction of the National Board of Fire Underwriters.

Let our nearest office show you why Universal Pipe for water supply, fire protection and other service is so much easier—quicker—safer . . . .

No bell holes to dig: No joints to calk

Subsidiary of The Universal Pipe and Radiator Company
Graybar Building, 420 Lexington Avenue
Chicago Birmingham New York Dallas San Francisco



SELF-PROPELLED

A New CP Compressor Car for Railroad Service

Our many years' experience in building air compressors of all types has been combined with the practical suggestions of experienced railroad men who have assisted in the design of this new complete unit. It is built in sizes of 100, 160, 220 and 310 cubic feet per minute displacement. The standard CP gasoline engine driven portable compressor with its famous Simplate Valve, Auto-Pneumatic throttle and other exclusive features, is mounted on a truck frame carrying flanged wheels with Timken roller bearings, transverse shifting wheels, a transverse towing winch and air operated lifting jacks. The car is propelled at a speed of 12 to 18 miles per hour, depending upon the size. These and other interesting features of this latest CP development are illustrated and described in Bulletin No. 789 which will be sent upon request.

C-279

Chicago Pneumatic Tool Co.

Railroad Department

6 East 44th St. New York | 1004 Mutual Bldg. Richmond, Va. | 310 S. Michigan Ave. Chicago

In 1889 this main was laid by the old New Orleans Water Co. On the left it is shown being salvaged 24 years later. And on the right, in perfect condition, the same pipe is being relaid in the water system of Port Arthur, Texas.

After 24 Years

this cast iron pipe starts a new job

USUALLY when cast iron pipe is laid, it is in the ground for good. It can be forgotten. A century or two of service is no uncommon record.

But, in rare instances, pipe lines must be removed as in the case of this main installed many years ago in New Orleans. The left-hand photograph shows it being taken out of the ground in perfect condition, after almost a quarter century of service. And at the right you see the same pipe starting again in service under the streets of Port Arthur, Texas. Nothing could illustrate more forcefully the age-defying quality of good cast iron pipe.

Much helpful data for the engineer and contractor is contained in the U. S. Cast Iron Pipe Handbook. Write for your copy now.

United States Cast Iron Pipe and Foundry Company

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Burlington, New Jersey

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New York: 71 Broadway

San Francisco: 3rd & Market Sts.
Pittsburgh: 6th & Smithfield Sts.
Dallas: Akard & Commerce Sts.
Kansas City: 13th & Locust Sts.
Minneapolis: 6th Street & Hennepin Avenue

Railway Engineering and Maintenance

Volume 24 October, 1928 No. 10

Closing Switches

FOUR persons were killed and 11 injured in two recent accidents in widely separated parts of the country, because of the failure of section foremen to close main line switches which they had opened during the course of their work, according to reports of investigations of these accidents, made by the Interstate Commerce Commission. These casualties, which are chargeable to shortcomings of maintenance of way department employees, can be attributed only to carelessness. They involve no hidden defects in materials or other extenuating circumstances.

In one instance a track gang was bringing a rail into a rail rack at the section headquarters on a motor car and a push car and, while the testimony was conflicting, the commission concluded that the switch was opened to permit the motor car and push car to enter and was left open. In the other instance a section gang was working on a spur and used the switch several times during the day, leaving it open. In both of these instances passenger trains were derailed, with the results noted above.

Accidents such as these show the responsibility that attends almost every act of maintenance of way employees and the serious possibilities that may result from lapses. Measured in percentage of switch openings, the ratio of accidents is low, yet every such accident is one too many.

Laying Rail

THE RAILWAYS spend more for rail than for any other maintenance of way material with the single exception of ties, over $7 out of every $100 expended for supplies going for this purpose. The application of the rails to track and their care in service devolve upon the local maintenance forces, subject, of course, to standards of practice formulated by the chief maintenance officers. It is fitting, therefore, that a committee of the Roadmasters' association should study and report on this subject, as noted on a following page.

In this report the committee very properly places primary emphasis on the joint, for it is here that the deterioration most commonly occurs that makes necessary the renewal of the entire rail. In other words, the breaking down of 10 per cent of the rail brings about its renewal in its entirety.

To correct conditions at the joint, the committee emphasizes the importance of laying the rail properly in the first place. It is here that present practices are most deficient. One need not travel very far or observe the work on many roads to satisfy himself that much of the deterioration of rails is preventable by simple precautions. All too frequently the importance of laying the rail and of bolting up the joint properly is not appreciated, or if appreciated, is not adequately supervised.

Not infrequently over-emphasis is placed on speed in rail-laying operations with the result that the work is not well done. The first essential in laying rail is that the work be done properly, and production records should not be made at the sacrifice of quality. In justice to those who emphasize the necessity for production, it should be stated that the two essentials are not necessarily in conflict. Rather, careless and deficient practices are not infrequently found where production also leaves much to be desired.

Roadmasters and division engineers have few more important tasks than the conservation of their rail. The manner in which rail is laid affords an accurate measure of the ability of a foreman. It is likewise an index of the ability of the roadmaster and division engineer.

The Length of Sections

THAT the materials which a section gang is required to handle in the conduct of its routine operations are growing heavier, is generally realized. The 75-85-lb. rail sections, for example, have been replaced by those of 110-130-lb., and the standard length of 33-ft. is being rapidly supplanted by the 39-ft. length. Other materials have become heavier in like proportions. In the same manner, the equipment that is being furnished the track gangs is becoming heavier, more complicated and more expensive every year.

These changing conditions are causing not a few students of maintenance of way organization to question whether the organization for the maintenance of the track, the basic unit of which is the section gang, should not be revised to meet the new conditions. The problem is as yet confined essentially to the main lines for it is here that the changes noted above are found. It is here also that, by reason of multiple tracks in heavy traffic, the sections are now the shortest.

Whenever any one suggests that sections be lengthened he encounters the active opposition of most supervisors, for they fear that this may be merely a step toward the reduction of forces by extending the jurisdiction of the existing gang over a longer mileage. This, however, is not the issue, for the question, if fairly presented, contemplates the same number of men per mile of track, but grouped into larger units. With the average length of sections found on heavy-traffic main lines, an extension of perhaps 25 per cent does not seriously decrease the thoroughness of inspection. On the other hand, with the gang correspondingly increased in size, it becomes possible to do much work without outside aid which otherwise requires help from an adjoining gang. This makes it possible for a gang to do

such work at a time most convenient to it, and therefore most economically. Another not unimportant consideration is the fact that, by decreasing the number of sections, it becomes possible to pay the foremen who are retained a higher wage without increasing the total expenditure, and thereby raise the position to a higher level and make it more attractive.

New methods are coming rapidly in maintenance of way work. Those responsible for the economical administration of these operations must study these trends constantly to be sure that their methods are kept abreast of these changes in all respects.

Better Use of Wood

MANY AN old carpenter is still given to recalling the days when timber was plentiful and only clean, straight-grained stock was put into buildings of the better class, and when lumber was so cheap that no one thought of stinting in the sizes and number of joists and other pieces used in framing. Time has served to dim the recollections of what was bad, and intensify the memory of what was good, in the days gone by; but it is true, in the main, that select grades of lumber were proportionately more plentiful a generation or two ago than they are now.

With the depletion of the forests have come higher costs, which, on the one hand, impose on the lumberman the necessity of realizing a return on the poorer grades produced in his cut, and, on the other hand, a willingness on the part of the buyer to accept other than select or clear grades because the price is less. This is but the manifestation of an economic change, the passing of the period in American history, when the cost of lumber was little more than that of harvesting it from what was considered an unlimited supply. Perhaps we have not reached the status of Europe, where lumber cannot be produced any faster than the trees grow it, but we are at least approaching it.

Any abrupt changes, such as this, give rise to maladjustments and abuses that cannot be corrected in a day. Thus, rising costs of lumber resulted in sharp practices in grading, and a virtual chaos in sizes—a one-inch board was no longer one inch thick but almost any fraction from 5/8 in. up. But improper practices which were reflected in the use of wood in buildings were by no means confined to the lumber manufacturer and dealer. Higher prices resulted not only in the purchase of lumber unsuitable to the purpose but, in even greater measure, in flimsy construction as a means of avoiding the cost of adequate quantities and sizes. Lumber, therefore, received a black eye and builders turned to other materials—often where wood construction, properly carried out, was the economic solution.

But much of this is now history. Through the efforts of wood producers and users, collectively and individually, and through the work of the forest service bureaus of the United States and Canada, standards of good practice have gradually come into being. The properties of wood have been investigated, and it is now possible to select the best wood for every purpose, taking into account the various species commercially available in any given territory. It is possible to design structural frames built of wood with a greater degree of accuracy; there is now no excuse for either flimsy or wasteful construction.

Even greater advances have been made in commercial practices. Specifications define grades of lumber so completely that nothing short of outright dishonesty can explain improper grading. The adoption of definite rules covering actual sizes has done much to overcome the confusion that has prevailed in this regard. Another step forward is seen in the growing practice of marking each piece at the mill to indicate its grade and the identity of the producer.

However, improved business methods in the manufacture and marketing of lumber comprise only one step in the program for a better utilization of wood. It is only a little more than a generation since the time when no one saw anything wrong about the use of untreated wood in sidewalks. In view of this, it is easy to understand why some builders continue to set untreated sills or posts on the ground or resort to other forms of construction that encourage early decay. There are also right and wrong ways of framing and, in too many cases, the wrong way has been used simply because very few people seemed to know the difference. Recognizing these shortcomings in the use of wood, primarily in buildings, the lumber manufacturers are undertaking a campaign of education to point out the fine points in building construction. Some of these may seem exceedingly simple after they have been explained; for example, those discussed in the article on house framing appearing on another page of this issue. But this embraces only one of many opportunities for improvement in wooden building construction which will eventually result in better buildings and a more economical use of our forest resources.

Work-Train Equipment and the Job

THERE ARE few phases of maintenance of way work which afford such opportunities for economy, or, on the other hand, present such risks of waste, as the selection of equipment for work-train service. When one contrasts the unloading of dirt or ballast from self-dumping cars with the old method of shoveling the material off by hand labor, the value of modern appliances is brought home to an extent which is not always realized fully by the younger generation of maintenance men who take such equipment more or less for granted.

The choice of equipment has always been closely interwoven with the problem of operation, but never as largely or in as many different ways as it is today. While economy and efficiency have always been the goal of the ambitious supervisor or roadmaster, he is compelled to carry on his work with the means at hand and this often implies that he must do with equipment which is not best suited to the task. Under the best of conditions this must occur occasionally, but where it becomes chronic it is time for somebody to do something about it, and that "somebody," in the last analysis, is the management, although plenty can be done by all concerned in the preparation of the case which is submitted to the management for decision.

The true measure of the value of any labor-saving equipment is not alone the saving it can effect in some particular piece of work, but the amount of such work to be done, and the extent to which it can be kept busy, either for some specific purpose, or as an all-around tool for various phases of railway service; this applies with special force to work-train equipment. The ideal situation is one where the equipment can be used interchangeably in either work-train or transportation service, and where its use for either of these purposes will not interfere with the requirements of the other. This is well illustrated by the various types of self-dumping cars on many northern roads, where they are available for maintenance of way service during the months of milder weather, when the work of distributing ballast,

widening banks and grading for additional tracks is carried on, and for the transportation of coal during the winter, when the movement of that commodity reaches its peak. An example of more limited application is found in the spreader, which may be used interchangeably for grading and ditching in the open months and for clearing tracks of snow and ice during the winter.

Most labor-saving equipment saves money, not only by reducing the number of men necessary to do the work, but also by reducing the time required. This redounds to the advantage of the transportation department by lessening the time the work train must occupy the main track for any given operation and thus reducing the interference with revenue traffic. This is a point which should always be kept in mind when the choice of equipment is being considered, since the element of speed in handling traffic is assuming greater importance than ever before.

The Use of Cars

ONE OF the outstanding achievements of the railways, since their return from federal control, has been the greatly intensified utilization of equipment which they have effected. This is evidenced by the fact that they are handling a traffic that approximates record levels with an actual decrease of nearly one hundred thousand in the number of cars in service, and that this is being done without a shortage of equipment. In fact, there has been at all times a surplus of cars within recent years. This has been made possible only by the more efficient utilization of this equipment—by moving it more rapidly while en route, and even more, by the elimination of delays at the points of loading and unloading.

The progress which the railways have made in this direction has been made possible largely through the co-operation of the shippers. The roads have conducted aggressive campaigns of education to acquaint their patrons with their mutuality of interest in promoting the use of equipment, working with the shippers both individually and collectively through the regional advisory boards. To these shippers belongs the credit in no small measure for the results which have been secured.

In the handling of the vast quantities of rails, ties, bridge and building materials, etc., the maintenance of way department occupies the position of a large shipper. In the transportation of the materials required for its operations, it uses equipment of the same character as the railway patron, and while this equipment is in company service, it is not available for earning revenue. The magnitude of the demand which the maintenance of way department makes on the service of the transportation department is heavy.

For the purpose of stimulating interest in this subject among the officers in the branch of railway service that makes the greatest demand for transportation, R. H. Aishton, president of the American Railway Association, suggested to the members of the Roadmasters' Association, when speaking before them at the Buffalo convention last year, that the use of equipment in company service be assigned to a committee for report this year. This suggestion was accepted by the executive committee and a constructive report has been prepared which is presented on a following page. While referring specifically to the transportation of materials used primarily in the maintenance of tracks, the principles discussed apply with equal force to other maintenance operations involving the use of revenue-earning cars.

In its report, the committee calls attention to numerous ways in which the demands for equipment can be reduced by more thorough planning. Some of the unnecessary demands on equipment that now are being made are unintentional and result from a lack of appreciation of the full cost of transportation. Others result from a deliberate attempt to reduce the direct departmental costs at the expense of the more indirect transportation charges, ignoring the fact that the railway is the common employer of both the transportation and maintenance of way departments and must pay the bills of each. That there are still many opportunities for improvement, in spite of the attention that has been given the subject on some roads, is indicated by a statement of the committee that "In many cases we have educated our patrons considerably more than our own employees in this respect."

One road has made distinct progress in the conservation of the tools and materials furnished its forces by requiring them to show the cost of every unit of material ordered when making out requisitions. In this way it has impressed on them the fact that supplies cost money. If it were possible to assess against each department the charges called for in the tariffs for the transportation of company materials, and to show these charges on each way bill, the cost of this service would be brought so forcibly before maintenance officers as to lead immediately to the correction of many wasteful transportation practices which are now continued because of a failure to appreciate their cost.

Is Cement Just "Cement"?

TWENTY-FIVE years ago the usual excuse for poor concrete was "bad cement," but with the better knowledge of concrete that we have today, we know that there are other reasons for concrete failures and that the cement must often have been unjustly blamed for defective concrete. Still, the fact remains that the manufacture of portland cement was not always as highly developed or as carefully controlled as it is today, and undoubtedly "bad cement" sometimes got into concrete a generation ago. There is, of course, little excuse for the use of defective cement today. With standard specifications universally recognized and with standard tests for their application, the user is almost certain to secure, in the portland cement he buys, at least the minimum requirements demanded by the specifications.

Such assurance has become so well established in the minds of the users of concrete that to many of them, portland cement is just "portland cement," and they are perfectly willing to have one brand substituted for another. Of late, however, certain new developments have presented themselves which have given rise to some definite questions with respect to this assumed uniformity in the properties of portland cement. Men are beginning to ask themselves whether one brand is just as good as any other under all circumstances or conditions of use, and occasionally ask whether portland cement as manufactured under the standard specifications is the most suitable material for certain particular uses—for example, for concrete in sea water. No conclusive facts have been brought forth which throw any definite light on the latter query, but data, presented in a report made before the American Society for Testing Materials, show that there are definite differences in the behavior of different brands of portland cement in concretes exposed to sulphate waters.

A new factor has been introduced with the advent

of special hydraulic cements capable of producing concrete having a strength, in 24 hours, approaching that of portland cement concretes at the age of 28 days. The many opportunities for economies in railway, highway and other construction operations of especially difficult characteristics, through the use of such cements have been recognized and they have had wide use. Following the introduction of these special cements, certain manufacturers of portland cement directed attention to the possibility of obtaining accelerated strength with the use of their products by employing lower water-cement ratios, i. e., richer mixes. Still more recently it has been shown, as the result of a series of tests, that certain accelerators, such as calcium chloride, have more effect in increasing the strength of concrete with the use of some brands of portland cement than they have with others.

These and other developments serve to spur the users of cement to a more critical attitude. While recognizing the unquestioned advantage of a standard specification for portland cement, by virtue of which the cement is largely eliminated from among the variables affecting the quality of the finished concrete as applied to most ordinary purposes, he ought to be on the lookout for the cement which will serve his purpose the best under special conditions.

Allowance for Rail Expansion

THE concerted attention which is now being given to one of the most perplexing problems of track maintenance, the battering of rail ends, has resulted in a rather general agreement on one point, namely, that damage to rails from this cause is more rapid during periods when the opening between the ends of the rails at the joints is the widest. There is less agreement as to the measures which can be taken to lessen this effect.

There are those, for example, who contend that rails must be laid with adequate expansion allowance to insure against stresses due to "tight rail" during maximum temperatures. This requirement can be met in territories subject to only moderate ranges of temperature without excessive openings at the joints when minimum temperatures prevail, although where the range is great, full allowance for expansion results in maximum openings between rail ends which some engineers deem excessive.

On the other hand, there are those who contend that the development of appreciable compressive stress in rails during periods of maximum temperature is not objectionable because the stiffness of the rail and the strength of the entire track structure are now such as to afford adequate resistance to the tendency to buckling induced by compressive stresses. For this reason, they feel that it is entirely safe to make less than the full allowance for expansion when laying rail. As a result, considerable tonnages of rail are now being laid with restricted expansion allowance, although, in general, this practice follows the dictates of individual judgment rather than well-defined rules specifying safe limits or outlining methods of procedure. One difficulty attending this practice is to carry it out in such manner as to secure uniformity of results, for while it is possible to lay rail during cold or moderate weather in such a way as to allow less than the full expansion, it is impossible to do this when the temperature of the rail approaches or reaches the maximum. This is a subject of such importance as to be worthy of more thorough consideration and discussion than it is now receiving.

What Our Readers Think

Can You Equal It?

Portland, Ore.

TO THE EDITOR:

In the July issue of *Railway Engineering and Maintenance*, page 284, you published a letter from George H. Warfel, assistant to general manager, Union Pacific System, calling attention to the remarkable record which the Colorado division track forces had made in working a full year without a single day's loss of time from duty although an average force of more than 700 men worked a total of 1,900,200 man hours.

We have a roadmaster on the Oregon-Washington Railroad & Navigation Company, J. W. Cheatham, on our Third division, with headquarters at Colfax, Wash., who has not had a single lost-time accident among his forces since he was appointed roadmaster in 1925, in which time his forces worked 1,096,800 man hours. While this latter figure does not yet quite equal the record cited by Mr. Warfel, I believe that Mr. Cheatham will continue the performance made thus far and will eventually exceed the record quoted by Mr. Warfel.

J. F. GRODZKI,
General Safety Agent, Oregon-Washington Railroad & Navigation Company.

The Size of Tie Plates

Brooklyn, N. Y.

TO THE EDITOR:

In your July issue, page 284, there was published a letter entitled "Are Tie Plates Wide Enough" and signed "Maintenance Engineer," on which you commented in your editorial "Should Tie Plates Be Wider." Has not the most important point in connection with the use of tie plates been overlooked by both you and "Maintenance Engineer," although the latter commences his letter by referring to this point? I write of the question of an adequate fastening of the tie plate to the tie, which cannot be better put than by quoting your correspondent's letter:

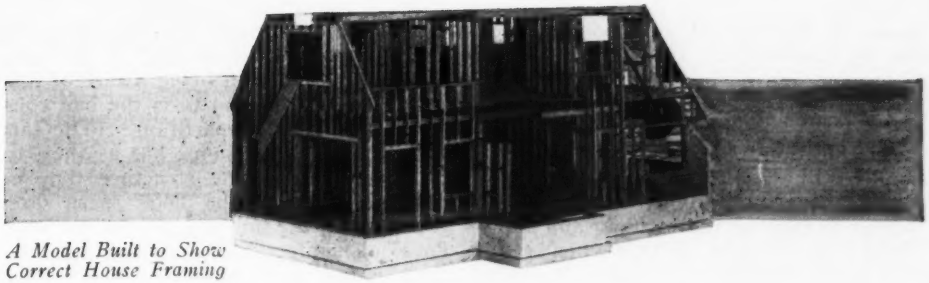
"To function properly a tie plate must become virtually a part of the tie and retain its position undisturbed by any rail action that takes place."

Yet, with few exceptions, tie plates in this country are allowed to be loose on the ties, owing to their only fastening being the one which has to hold the rail down as well.

Are we not premature in discussing the size of tie plates before the more important one of deciding how "they are to become virtually a part of the tie?" Up to the present, opinion appears to be divided as to the advisability of a tight fastening between the tie plate and the tie.

An interesting article by Dr. Von Schrenk, entitled, "Mechanical Wear of Ties," appeared in the last bulletin of the American Railway Engineering Association, dealing with this subject [This article was abstracted on page 372 of the September issue.—Editor] which should go far toward convincing unbelievers that increased length of life of ties will be effected more by eliminating mechanical wear between the tie plate and the tie, through a positive fastening, than by an increase in the size of the plate. This principle has been admitted for some years past in Europe.

J. A. REED.



A Model Built to Show Correct House Framing

Better Practices in Constructing Frame Buildings

Simple Rules for Framing That Will Equalize the Settlement Due to Shrinkage of Joints, Plates and Sills

ORDINARY house carpentry is so many centuries old that one would naturally suppose that rules of good practice would be well established. That this is not the case, however, is shown in the report of the Consumers' Subcommittee on Seasoning, Handling and Care of Timber, of the National Committee on Wood Utilization. For example, standard books on carpentry give rules for house framing which, if followed, will equalize or avoid most of the settlement resulting from the lateral or cross-grain shrinkage of joints and sills. Yet, inspections made for the committee of a large number of homes failed to disclose a single one in which the rules were followed in spite of the fact that the extra cost of observing such rules would add less than $20 to the cost of a $10,000 house.

While the report deals primarily with frame dwelling house construction, the points discussed apply to any building in which wooden joists and interior frame bearing partitions are used. Its message is, therefore, of direct application to small passenger stations and many other types of railroad buildings, and is reproduced in part below.*

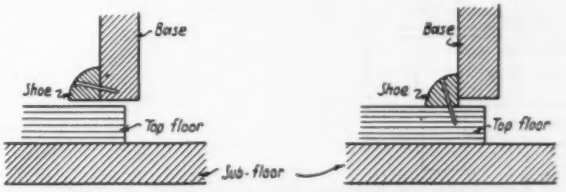
Overcoming the Effects of Shrinkage

All wood, even when brought by seasoning into balance with the air, tends to change with changes in the humidity of the air surrounding it. While this change is slow and may be further retarded by partially segregating it from the air by protective coatings and in other ways, it can not be entirely prevented. Good design, therefore, assembles wood in such a way that it can shrink and swell—or in some cases confines it so as to oppose and overcome swelling stresses.

Design usually must allow for the slight changes in lateral dimension that are bound to occur in well-seasoned wood under the influence of air, instead of attempting to restrain them. Examination of almost any assembly of wood will show that each piece can swell or shrink laterally in relation to at least one free edge or surface. An important exception exists in edge-joined coverings such as floorings. Most patterns of interior finish are comparatively narrow and have little lateral movement, scarcely perceptible upon the plaster upon which they are applied. Wall base or skirting is about the widest pattern and is usually nailed most solidly near the floor, so that its movement will be at the upper edge, and that the light nailing near the top will probably yield to permit this, being of slender finishing nails. Mitered corners open at the inner angle if the wood shrinks and at the outer if it swells; but such miters are mostly in the thickness of thin molding at corners of the room and the joint is not deep enough to open very visibly.

Improper Nailing of the Shoe Mold

In general, present patterns of interior finish and the manner of their application take very good care of such slight shrinkage and swelling as is sure to occur. One striking exception is the almost universal neglect of floor settlement away from wall bases. Where the floor joins an outside wall not affected by joist shrinkage, or where a partition is carried down to its proper bearing to the girder or partition cap below, the top of the floor is still affected by the shrinkage in floor joists, though the base is not, and the floor may settle away from the base nearly one-fourth inch. A shoe mold—often a quarter round—



Right and Wrong Ways of Fastening a Shoe Mold

The common method, of nailing the quarter round to the base, is shown at the left; the floor has settled and opened a crack connecting with the wall interior, admitting cold air and insects. With the mold nailed to the floor boards, as shown at the right, it settles with the floor, sliding down the base and avoiding a crack under the wall.

is applied in this angle and, if nailed to the floor only, slides down the base when floor settlement occurs or up when the floor joists again swell, remaining tight. However, it has been found almost universally nailed to the base, which means that the settlement crack which opens under the base will also appear under the molding. A legend has been found on a plate in a book of architectural details which reads "Nail the shoe molding to the floor, not the base"; and this

*From the fourth of a series of bulletins on the marketing of lumber, published by the United States Department of Commerce. Sold by the Superintendent of Documents, Washington, D. C.

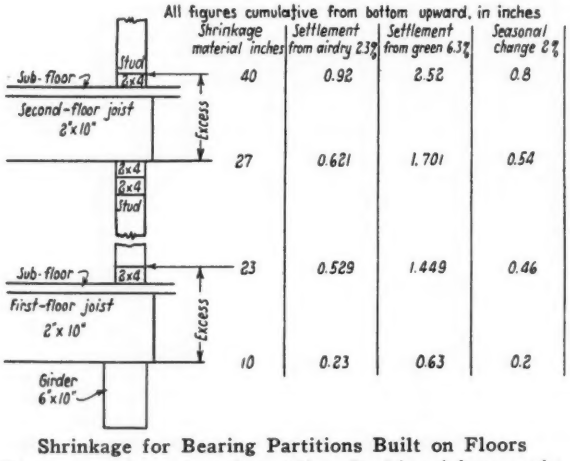
method is shown in the illustration (Good Practice in Construction, by Knobloch, Pt. II, Pl. 3), but there is no text discussion, and no other reference to the point has been found in an extended search of standard works.

The proper specification to "nail to the floor only" should be completed by the direction to the carpenter to nail lightly in fitting, not driving nails fully in; and to the painter to take off the molding and apply the finish behind it on the base, so that when settlement occurs a "grin" of unfinished wood will not be exposed over the molding. A survey has shown this to have been the procedure used in a number of instances where the molding was wrongly nailed, and it saves brush labor whenever the shoe molding is finished in a different way from the base—usually darker, so that it will not show the soiling which it frequently acquires from floor dirt.

Improved appearance may not be a very important point here. Far more important is the fact that settlement cracks around the floors afford access to wall interiors, the chief hiding and breeding places for water bugs, ants, and similar nuisances. Their appearances in the open are merely forays; they can not live there continuously. Construction that will remain tight, and proper attention to plaster holes around plumbing and to the spaces behind hollow-backed enameled-iron sinks that the plumber never does stop off in erection unless it is insisted on, will make less work for the exterminating concerns.

Bad Effects of Shrinkage in Building Frames

In one important particular, buildings are being framed in such a manner that they are sure to be distorted and racked by subsequent lateral shrinkage and swelling, although the methods of minimizing or avoiding this bad effect are well understood and



Shrinkage for Bearing Partitions Built on Floors

This may properly match wooden outside walls of braced frame or platform frame, but is often improperly used with outer walls of balloon frame, brick, stone, etc., all of which call for a minimum of shrinkage material in the bearing partition. In such cases the partition studs should be extended down to rest on the bearing below the floor joist, which cuts out at each floor the 13 in. of shrinkage material marked "excess" in this illustration.

are discussed in most works on carpentry. The bad practice is a little easier and a little cheaper; but the difference in labor and material amounts to only about $10 per floor of an average building, while the depreciation in value of the completed building is many times that. The practice merely means that those interested in paring the cost of construction for the benefit of their own pockets have been permitted to cut an undesirable corner and those interested in adequate and substantial construction of the building have permitted themselves to be imposed upon, usually without even being aware of it.

The matter referred to is the bad construction of the interior bearing partition. (The same fault appears in other partitions, but as they are not load-carrying parts of the structure they need not be discussed here.) The floor spans do not usually reach across the building unless it is very small; the floor joists meet in the center, and their ends are there lapped and supported, in the first floor, on a center girder with ends resting on the wall foundations, and further supported along its length by one or more basement columns—or piers, if there is no basement. The bearing partition is carried up over this girder and in turn supports the inner ends of the second-floor joists; and, a story higher, similar support is provided for the inner ends of joists, which may be those of a third floor, or of the ceiling.

Bearing Partition Is Important

It will be seen at once that this bearing partition is an important main member of the structure. It carries one end of both spans of floor joists and has, therefore, double the floor lpad of either of the outer bearing walls, each of which carries the outer ends of only one span.

Proper and improper methods of framing this partition are discussed in most carpentry works; the following quotation is selected from Page 34 of Construction Carpentry, by C. A. King, published in 1912:

> The best construction practice is to bring the partitions directly over one another, as much as possible, supporting the upper by the lower, with a scantling plate between the two to prevent the passage of fire and vermin and to support the floor joists. This method of putting in the partition minimizes the danger of plaster cracks in the corners, as the partitions of both floors are supported by the girt of the lower story, thus making the shrinkage of the house practically the same in the partition and outside walls. *If a house is built by laying the floor and starting the partitions upon it,* there will always be cracks in the plaster when the building settles. This method has nothing to recommend it but its inexpensiveness, *and is used only upon the cheapest class of houses,* except as it is the method by which a closet or other unimportant partition is framed.

The above needs qualification by applying it chiefly to the bearing partition (as indicated by the reference to the support of ends of floor joists) and also by carrying down the bottom of the partition to rest upon the center girt, thus making good the statement that the partitions of both stories are supported by it.

This Defect Found in Most Houses

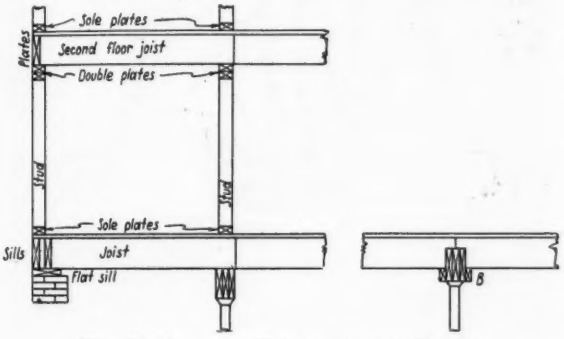
The italics in the above quotation were not the author's and have been used to direct attention to the statements. It must be added also that the "cheapest class of houses" referred to has been shown by the survey made for this report to include not only those built for later sale by the builder but houses being erected on contract; not only those built from stock plans but some built under architectural design; not only wooden houses of moderate cost but so-called brick or stone or cement houses (with wooden interiors) running up to selling prices as high as $35,000. A special effort was made to discover somewhere a house in which the method of framing the bearing partition on a bearing below floor joists, as described by the above author and other standard authorities, had actually been used, but this effort failed. In the completed building, the framing of course is chiefly closed in against observation, but in

the basement (if unplastered) it can still be seen whether any partition studs come down beside the joist to rest on top of the girder.

The bad practice consists in laying the diagonal subfloor over the floor joists when they are set, providing a working floor, then nailing down on this the two-by-four scantlings which are to serve as sole plates for the partitions and erecting the studding on these, placing a two-by-four cap or plate on top of the studding and below the second-floor joists (which cap in a bearing partition supports the second-floor joists and should, therefore, be doubled two-by-four, although in cheap work it is often left single). This process is repeated on the second floor.

The Correct Method

Correct procedure is to set the partition studs for the bearing partition after the first-floor joists are placed, carrying each stud down beside a joist and resting it on the girder. The diagonal subfloor can then be laid, and it can be laid through the bearing partition, if desired, but it must be fitted around the studs and should be supported where the studs cut



The Platform or Western Frame Design

Note that all shrinkage items match in both wall and partition, except at the bottom where the partition has a 10-in. depth of center girder, and the outer wall only a 2-in. depth of flat sill.

it. Nailing blocks, fastened to the sides of the studs away from the floor joist, will supply the support. On top of the subfloor, and between the studs, pieces of two-by-four are then cut in and nailed where the omitted sole plate would have come, to serve as fire stops between interior spaces of the floor and the partition above (the subfloor not being a sufficient barrier) and also to give solidity to the bottom of the partition behind the base and plaster. This takes a little more labor than the other method and a little more material in the longer studs required to reach the lower bearing. The process is repeated on the second floor, carrying the studs down to the partition cap below.

The "cheap" method adds 13 in. of needless shrinkage material at each floor level, if the floor joists are 10 in. deep, 1 in. of subfloor and 2 in. of sole plate making up the rest. The diagram shows a total of 44 in. in two stories of such a partition, and the tabulation beside the figure shows the shrinkage settlement from an air-dry condition of the wood (figured at 2.3 per cent), accumulating to over an inch at the top. The next column shows shrinkage from green condition (figured at 6.3 per cent) cumulating to a maximum settlement of over 2½ in. at the top. The last column demonstrates that such careless construction of the bearing partition will produce bad results where the outer walls have little or no settlement—even if all the material were very thoroughly seasoned when used—because exposure in winter to the hot and very dry air of interior heating and during the unheated months to usual humidities will cause a maximum range of shrinking and swelling of about two per cent and a variation in the height of the partition of nearly nine-tenths of an inch, where a half inch would be about the limit of tolerance.

There are methods of framing a wooden building which place enough shrinkage material in the outer walls to balance or "equalize" a bearing partition of this sort, such as the platform frame which is discussed farther on. If the outer walls are of brick or equivalent material, they are not directly affected by lateral shrinkage of wood, although they will probably have some settlement. Outer frame walls are now largely of balloon-frame construction, with no shrinkage material except in the foundation sill, which may be a flat sill only 2 to 4 in. deep, or less often a box sill 10 or 12 in. deep, and perhaps with the thickness of subfloor and sole plate added under the foot of the studding. To match such outer walls, the bearing partition must have little shrinkage material.

The chief distortion occurs in the cross partitions. Where they meet the bearing partition they must settle with it and the floors, having little settlement or none at the other end where they join the outer wall. This distortion produces diagonal cracks in the plastered wall and forces door openings out of true; doors bind, and the lock bolts will no longer catch.

Framing Design in Platform Frame Houses

It has already been stated that the survey of dwellings made for this report did not succeed in finding any instance where the bearing partition had been supported below the floor joists to reduce surplus shrinkage in relation to the outer wall. That statement stands; but one house was found under construction in which there was a fair equalization of shrinkage through the inclusion of added shrinkage material in the outer walls to balance the partitions. This was a ready-cut detached wood house from a mail-order institution, of what is known as platform or western frame design. Double plates were used on top of all partitions (although needed only where the caps carry the ends of the floor joists), because this brought all the studs of a floor to the same ready-cut length and simplified construction. Where balloon construction is used in a few cottages, the construction of the first floor and of all partitions is the same as for the western frame, and excess interior shrinkage material occurs only in the second floor and in the wooden center girder. No attempt is made to reduce this by bringing the second-floor bearing partition down to rest on the cap below the floor joists; and it may be that the western frame was adopted chiefly because of its simplification of ready-cut material and of its erection.

FIFTY YEARS AGO.—An accident to a train in Michigan on August 28 resulted from a very unusual cause. It occurred on the Grand Rapids & Indiana (now part of the Pennsylvania), whose gage is 4 ft. 9½ in. The cars were from the Flint & Pere Marquette (now part of the Pere Marquette) which has a gage one inch narrower, and the excessive play between the wheels and the rails forced one or more of the trucks from the track.—*Railway Age*, September 5, 1878.

Simple Expedient Solves Problem in Bridge Erection

Raising of Track Grade Reduces Sag in the Line and Makes Room for New Girders Above Tops of Old Trusses

By P. G. LANG, JR.

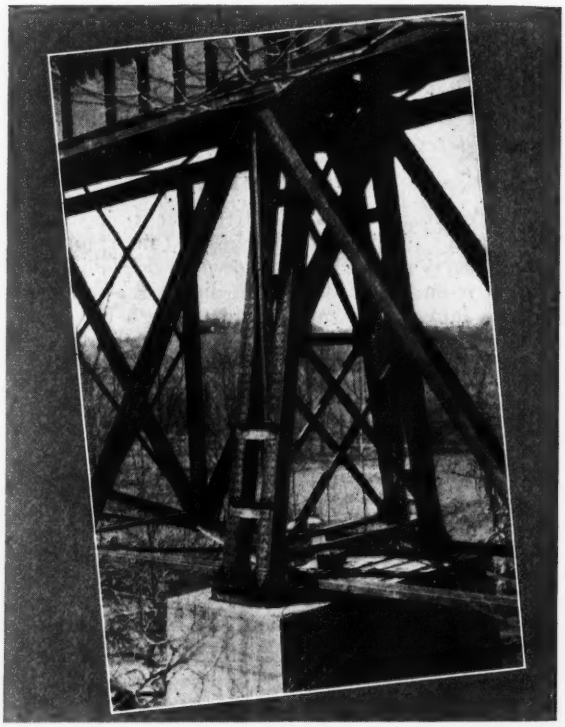
Engineer of Bridges, Baltimore & Ohio, Baltimore, Md.

BY MAKING a five-foot raise in track level on a bridge that was located in the sag between two descending grades, it was possible to adopt a construction procedure that eliminated many complications in the replacement of the old bridge. This structure comprises the crossing of Muscatatuck creek at Lovett, Ind., on the line of the Baltimore & Ohio between North Vernon, Ind., and Louisville, Ky. The old bridge consisted of two 180-ft. deck, pin-connected truss spans and was built in 1894. This structure was stressed to

The Old Pier Was Relieved of Its Load

the limit of its carrying capacity by the power regularly in service and certain engines were permitted to cross it only under the restriction of a slow order.

This slow order was objectionable, especially for tonnage freight trains, because of the physical characteristics of the line in the vicinity of the bridge. The structure is located at the foot of descending grades from both the north and the south. There was a grade of 0.7 per cent for a distance of 1½ miles to the north,



Steel Bents Were Built to Clear the Trusses

representing a drop of approximately 54 ft., and a grade from the south of approximately 0.73 per cent for a distance of 1⅞ miles that involved a descent of about 72 ft. Under these circumstances observance of a slow order was obviously difficult, and any raise in the grade that could be made conveniently and economically in connection with the reconstruction of the bridge would clearly be of benefit to operation.

Old Pier in Poor Condition

The center pier supporting the two truss spans, the other ends of which were supported on masonry abutments, was in poor physical condition. About a year ago it had become necessary to relieve this pier of load, and this was done by placing timber bents on each side of the pier and supporting the truss spans on I-beams spanning across its top. However, the defects in this pier which made this necessary were confined to the upper 15 or 20 ft. The lower portion and the foundation was good; in fact, the pier was footed on rock.

The truss spans had a floor system composed of floor beams resting on the top chords at the panel points; that is, not framed into the posts at these points. The stringers, as is the usual custom, were framed in between the floor beams, the top lateral system of the trusses being in the plane of the bottom flange angles of the floor beams or the plane of the tops of the top chords.

Since it was necessary to rebuild the upper portion of the center pier, and since plate girders, particularly

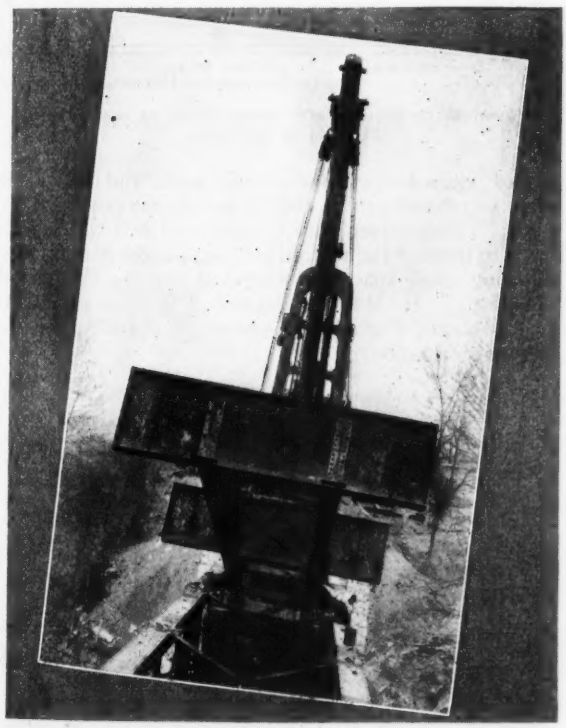
deck plate girders, have proved economical in cases of replacement, in so far as first cost and ease of erection are concerned and also with respect to future maintenance costs, this type of superstructure was adopted.

Numerous studies and estimates were made and it was finally developed, primarily because suitable rock foundation was close to the ground surface, that the most economical procedure in this case was to double the number of spans; that is, to provide a new pier at the mid-span of each truss and use four deck plate girder spans approximately 90 ft. long for the superstructure. The new piers were built to a height that would just clear the bottom chords of the truss spans.

Arrange to Place Girders Above Trusses

Due to the type of floor system in the existing truss spans, a depth of approximately five feet from the base of rail to top chord was occupied by the ties, floor beams and stringers. Consequently, if the track across the bridge were raised by another five feet it would be possible to place the new deck girder spans entirely above and clear of the existing truss spans. The track was accordingly raised approximately five feet by the use of timber cribbing, consisting largely of second-hand 8-in. by 16-in. timber stringers and second-hand bridge ties and trestle caps from timber structures which had been replaced in permanent form during the year.

The track was raised very readily in 16-in. lifts. The



The Old Floor Was Removed Two Panels at a Time

spikes were first removed from every second tie on the structure (which are approximately 8 in. deep), the rail and alternate ties were jacked up 16 in. and 8-in. by 16-in. timbers, laid flat, were inserted on top of the ties from which the spikes had been removed, and which remained on the stringers, and under the alternate ties which were jacked up with the rails. After the track on this bridge had been raised in this manner there was available, considering both the cribbing and the truss span floor system, a height of approximately ten feet from the tops of the top chords to the base of rail, which was sufficient to permit the placing of the deck plate girders without fouling the truss spans.

The existing deck truss spans had vertical end posts carrying the reaction from the end diagonals down to the masonry. Detail studies developed that it would be

Erecting One of the New Girders

possible to place cross-girders on these end posts to carry the end reactions of the deck girder spans without interference with traffic and without disturbing the action of the truss spans. At the mid-span point of each truss span where a new concrete pier had been built careful detailing indicated the possibility of constructing a steel bent resting on each new pier, which could be placed around the existing truss span in such fashion that it could receive the ends of the new girders. With these bents in place the trusses would still act as ordinary simple spans.

Method of Erection

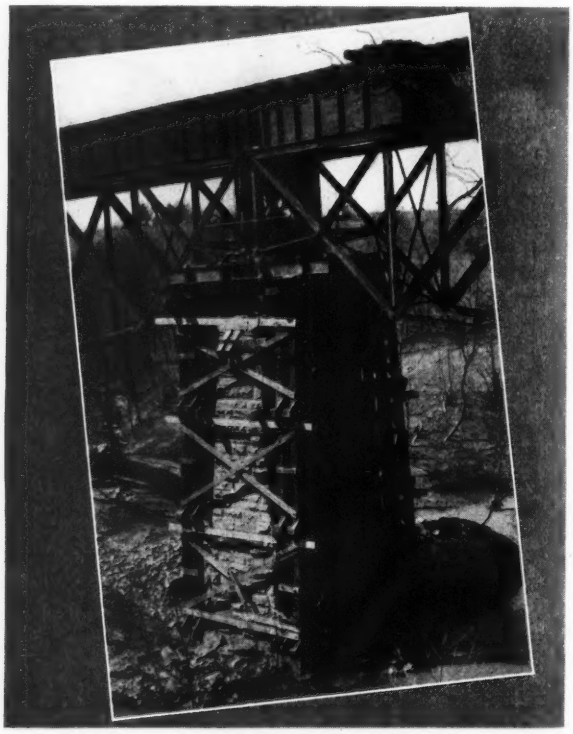
In erection it was then possible to remove the cribbing and floor system from one-half of the deck truss span; that is, for 90 ft. of its length, and place the new girders, supported at one end on the new cross-girder placed between the end posts of the truss span, and at the other end on the new steel bent resting on the new intermediate pier. For the remainder of the truss span the cribbing and floor system could stay in place and continue to carry live load as the top lateral system, sway brace system and, of course, the bottom laterals of the truss span were not disturbed.

Therefore, in one interval between trains, a 90-ft. girder span could be placed and traffic restored, the traffic being carried on the 90 ft. of girder and on the remaining half of the truss span, the span in this case again acting as an ordinary simple truss. The only difficulty arose from the fact that at the end the girder

span was on a solid foundation, whereas immediately adjacent to this point the truss deflection was a maximum. However, calculations indicated that for half-span load and at slow speed this would be so small as not to be objectionable.

The cribbing was cut into sections about 30 ft. long and, as shown in one of the views, each section was removed as a unit. Another view shows how the old floor system was taken out—two panels at a time. The new girders were placed by one bridge derrick with a hitch at the center point.

One of the illustrations shows the new girders in place and carrying traffic over the old center pier. It will be observed that the falsework for this pier was still in place at this stage of the work. Another advantage of this method of reconstructing this bridge consisted in the fact that, if the top of the old pier had been rebuilt before the new girders were placed, it would have been necessary to support the full end load of two 180-ft. truss spans on falsework while this was being done. However, with the girder spans in place the load to be supported during the reconstruction of the pier would be the end reaction of two 90-ft. girders or about half as much. A further advantage of the method employed is that the entire new structure was placed and the old structure removed without resorting to falsework, and no rolling or sliding operations were involved.



The Old Pier Was Not Rebuilt Until After the New Girders Had Been Erected

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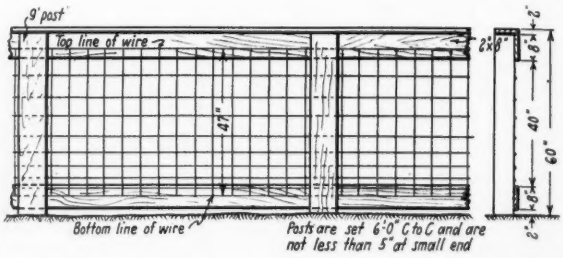
SPEED TESTS 25 YEARS AGO.—The Pennsylvania has made a speed test which seems to indicate that it is practically impossible to attain a speed of 100 miles per hour with a commercial locomotive. The trial was made on a 25-mile stretch of track with slightly descending grade, at the foot of which was a mile of level track.—*Railway and Engineering Review*, September 5, 1903.

Woven Wire in Stock Pen Fences

BEGINNING with the split rail fence of pioneer days, wood was long the only material used for fencing in this country, but with the invention of barbed wire and the subsequent development of woven wire fencing, lumber has been gradually supplanted as a fencing material, although wooden posts continue in extensive use. However, for stock pens, wooden plank is still the primary fencing material, although some roads have made experimental use of woven wire and a few have definitely adopted this material as standard for stock-pen construction. Among these is the Toledo, Peoria & Western, which builds a combination plank and woven-wire fence which has given good results.

The wooden posts used are heavy—not less than five inchs in diameter at the small end—and are spaced six feet center to center. They serve as the support for two planks placed edgewise, one at the bottom and the other at the top, with a third plank laid flat across the tops of the posts. The woven wire fencing used is the heaviest that can be had and, as shown on the drawing, it is placed against the sides of the posts and under the planks so that it can be stapled to both the posts and the planks. This woven wire is purchased in a width sufficient to overlap the bottom and top planks 3½ in., thus allowing ample space for staggered stapling. We are indebted to J. H. Markley, master of bridges and buildings, Toledo, Peoria & Western, Peoria, Ill., for the above information.



Woven Wire Stock Yard Fence Used on the Toledo, Peoria & Western

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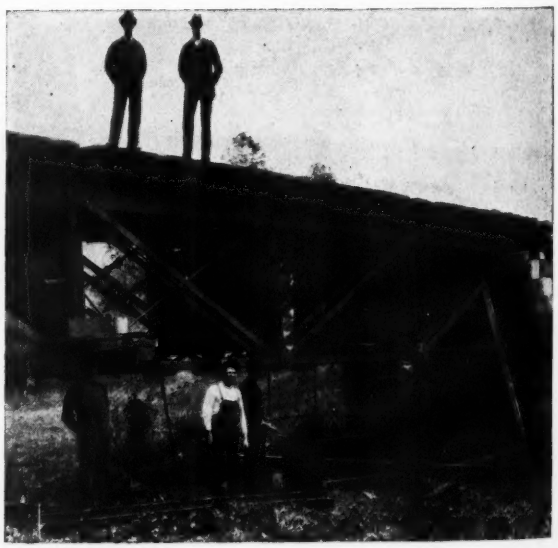


Bridge Building in the Old Days

More Roads Using Creosote Mixture

THAT THE treatment of track ties with a mixture of creosote and petroleum or of creosote and tar, as a means of reducing the cost of treatment as well as decreasing the tendency of the timber to check or split, is meeting with increasing favor is evidenced by the number of roads which are now using the process. In order to ascertain the extent to which this practice has been adopted, G. C. Stephenson, superintendent of the Port Reading, N. J., creosoting plant of the Reading Company and the Central Railroad of New Jersey, has collected data from the principal roads in the United States and Canada, including approximately 211,000 miles of lines, of which 174,000 miles are in this country, the latter comprising about two-thirds of the total mileage of the United States.

The data received has been tabulated to show the name of the road, the kind of mixture used, the proportions of the ingredients and the amount injected into the timber. From the table it will be noted that the percentage of petroleum in the creosote-petroleum mixtures ranges from 30 to 60 and that where tar is used its proportion ranges from 20 to 40 per cent. The Atchison, Topeka & Santa Fe, which was the first road in the United States to use the creosote-petroleum mixture, began the study of this process in 1908, using a mixture containing 30 per cent creosote and 70 per cent petroleum. Later, the proportions were changed to equal amounts of the two ingredients and then to 45 per cent creosote and 55 per cent petroleum, both of which proportions are now in use for different parts of the system. The Missouri Pacific also uses different treatments on its road, treating its ties for the Northern lines with a creosote-tar mixture and those for the Southern lines with straight creosote. The Texas & Pacific uses the straight creosote treatment for its gum ties and a mixture of creosote and tar for its oak and pine ties. On account of these variations on certain roads and the further fact that some roads, notably those having lines in arid or semi-arid regions, use both the mixture treatment and zinc chloride, the mileage is not a true measure of the extent to which any one method is employed but it gives an indication of the mixtures adopted, both as to ingredients and proportions.

As between petroleum and tar for the mixture, the table shows that the Canadian National, with approximately 22,000 miles of lines, uses both, with 70 per cent of creosote in each, while the Canadian Pacific, with 15,000 miles of lines, uses a creosote-petroleum mixture containing 70 per cent creosote. Of the roads in the United States included in the table, with an approximate total of 174,000 miles of lines, those with a mileage of 65,000, or 37.4 per cent of the total, employ the creosote-petroleum mixture, while the roads treating their ties with the creosote-tar mixture have a mileage of 75,000, or 43.1 per cent of the total. Roads with 22,000 miles are shown as

Railroad	Cross Ties — Kind of Treatment				Switch Timbers — Kind of Treatment				Absorption (In lb. per cu. ft. unless otherwise stated)
	Creosote-Petroleum		Creosote-Tar		Creosote-Petroleum		Creosote-Tar		
	Per Cent Creosote	Per Cent Petroleum	Per Cent Creosote	Per Cent Tar	Per Cent Creosote	Per Cent Petroleum	Per Cent Creosote	Per Cent Tar	
Atchison, Topeka & Santa Fe	50 45	50 55			50 45	50 55			8
Atlantic Coast Line			100						5
Baltimore & Ohio	50	50			50	50			8
Bessemer & Lake Erie			100						6
Birmingham Southern		Coal Tar Mixture				Coal Tar Mixture			8
Boston & Maine			60	40			60	40	6
Buffalo, Rochester & Pittsburgh			80	20			80	20	10.5
Canadian National	70	30	70	30	70	30	70	30	5.5
Canadian Pacific			70	30			70	30	6
Central Railroad of New Jersey	40	60			40	60			8
Chesapeake & Ohio			100						Not Stated
Chicago, Burlington & Quincy	$ZnCl_2$	(Western)		Card Process			$ZnCl_2$		
Chicago Great Western	$ZnCl_2$		80	20		Untreated White Oak			5
Chicago, Indianapolis & Louisville			60	40			60	40	10
Chicago, Milwaukee, St. Paul & Pacific	50	50	Also $ZnCl_2$						7
Chicago Rapid Transit			80	20			80	20	6
Chicago & North Western	50	50							8
Chicago, Rock Island & Pacific			(60	40					7 to
			(70	30					7.5
Cleveland, Cincinnati, Chicago & St. Louis			70	30					3.5 gal. per tie
Delaware, Lackawanna & Western			80	20			80	20	Switch timber 10
Denver & Rio Grande Western	55	45			55	45			Cross ties 2.5 to 3.5 gal. Fir, 5.6 Pine, 7
Duluth & Iron Range	50	50							8
Elgin, Joliet & Eastern			100				100		5
El Paso & Southwestern	70	30			70	30			7
Erie			80	20			80	20	Pine 6 All other, 8
Illinois Central			100						5.5
International-Great Northern	60	40							7
Kansas City Southern			70	30			70	30	3 - 3.5 gal. tie
Lehigh Valley			70	30			70	30	Switch timber to refusal Cross ties 2.5 to 3.5 gal.
Missouri-Kansas-Texas			(100				(100		
			(80	20			(80	20	6
Missouri Pacific (Northern lines)			80	20					
(Southern lines)			100						6
Minneapolis, St. Paul & Sault Ste. Marie			80	20	and $ZnCl_2$				6
Nashville, Chattanooga & St. Louis			80	20			80	20	White Oak 3
New York Central			60	40			60	40	Not Stated
New York, Chicago & St. Louis			80	20			80	20	6
New York, New Haven & Hartford			60	40			60	40	2 - 3.5 gal. tie Switch timber 10
Norfolk & Western			100						Not Stated
Northern Pacific	(50	50			(50	50			
	(45	55			(45	55			8
Oregon Short Line	50	50							Fir, 4 Others, 7
Pennsylvania			80	20					6
Pere Marquette		Zinc Chloride							Not Stated
Pittsburgh & Lake Erie			80	20					6
Reading	40	60			40	60			8
Seaboard Air Line			100						5 to 6
St. Louis-San Francisco			(70	30					
			(80	20					7
St. Louis Southwestern			80	20					2.5 gal. per tie, 6"x8"x8'
Southern			80	20					5.5 to 6
Southern Pacific	70	30							7
Texas & New Orleans	70	30							8
Texas & Pacific	Gum		100				100		
	Oak and Pine		80	20					
			70	30					Not Stated
Union Pacific	50	50	and $ZnCl_2$		50	50	and $ZnCl_2$		7
Western Maryland			80	20	Do not Treat				Not Stated

Table Showing Roads in United States and Canada Treating Ties with Creosote Mixtures

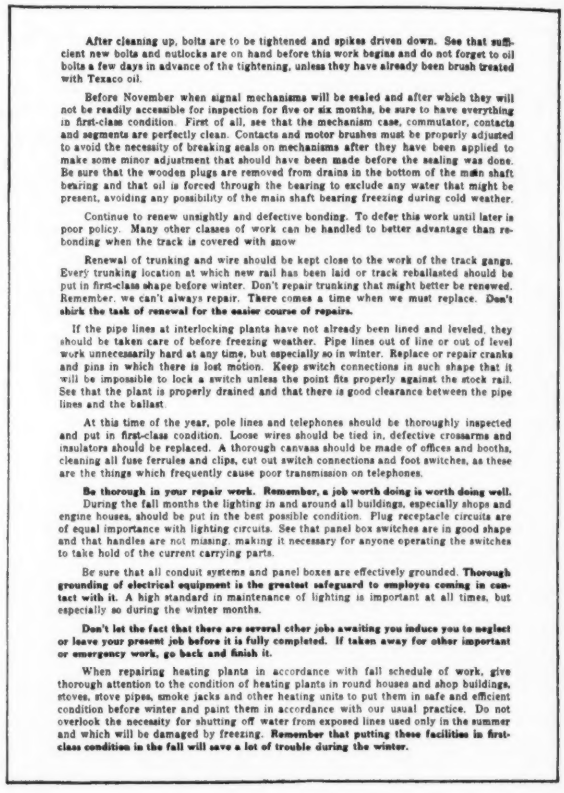
using the straight creosote treatment. Of the remaining mileage, the Chicago, Burlington & Quincy is shown as using the Card process and zinc chloride and the Pere Marquette as using only zinc chloride.

Further analysis of the table shows that, in general, the creosote-tar mixture is used by the roads in the East, while the creosote-petroleum treatment predominates in the West, but that this is not determined wholly by geographical location is shown by the fact that the Reading Company and the Central Railroad of New Jersey use a mixture of creosote and petroleum. On the other hand, the Kansas City Southern, the Missouri-Kansas-Texas, the Missouri Pacific, the St. Louis-San Francisco, the St. Louis Southwestern and the Texas & Pacific, with an aggregate of approximately 20,000 miles of lines, much of which is located in petroleum-producing territory, use a tar mixture.

B. R. & P. Bulletin on Preparing for Winter

BULLETIN No. 3, of the series issued to the maintenance of way and signal forces of the Buffalo, Rochester & Pittsburgh, is reproduced herewith, copies of others of these bulletins, having been printed in previous issues of *Railway Engineering and Maintenance*. This bulletin bears the same title as Bulletin No. 2, Details of Maintenance, but is devoted to a discussion of the various details to be looked after in preparing the track, structures and signals for the winter. It will be noted that the bulletin was issued on October 15, 1927, in order to give time to put the recommendations into effect before the advent of freezing weather.

That the preparations for winter are not preliminary to a drastic reduction in maintenance forces is evidenced



After cleaning up, bolts are to be tightened and spikes driven down. See that sufficient new bolts and nutlocks are on hand before this work begins and do not forget to oil bolts a few days in advance of the tightening, unless they have already been brush treated with Texaco oil.

Before November when signal mechanisms will be sealed and after which they will not be readily accessible for inspection for five or six months, be sure to have everything in first-class condition. First of all, see that the mechanism case, commutator, contacts and segments are perfectly clean. Contacts and motor brushes must be properly adjusted to avoid the necessity of breaking seals on mechanisms after they have been applied to make some minor adjustment that should have been made before the sealing was done. Be sure that the wooden plugs are removed from drains in the bottom of the main shaft bearing and that oil is forced through the bearing to exclude any water that might be present, avoiding any possibility of the main shaft bearing freezing during cold weather.

Continue to renew unsightly and defective bonding. To defer this work until later is poor policy. Many other classes of work can be handled to better advantage than rebonding when the track is covered with snow.

Renewal of trunking and wire should be kept close to the work of the track gangs. Every trunking location at which new rail has been laid or track reballasted should be put in first-class shape before winter. Don't repair trunking that might better be renewed. Remember, we can't always repair. There comes a time when we must replace. **Don't shirk the task of renewal for the easier course of repairs.**

If the pipe lines at interlocking plants have not already been lined and leveled, they should be taken care of before freezing weather. Pipe lines out of line or out of level work unnecessarily hard at any time, but especially so in winter. Replace or repair cranks and pins in which there is lost motion. Keep switch connections in such shape that it will be impossible to lock a switch unless the point fits properly against the stock rail. See that the plant is properly drained and that there is good clearance between the pipe lines and the ballast.

At this time of the year, pole lines and telephones should be thoroughly inspected and put in first-class condition. Loose wires should be tied in, defective crossarms and insulators should be replaced. A thorough canvass should be made of offices and booths, cleaning all fuse ferrules and clips, cut out switch connections and foot switches, as these are the things which frequently cause poor transmission on telephones.

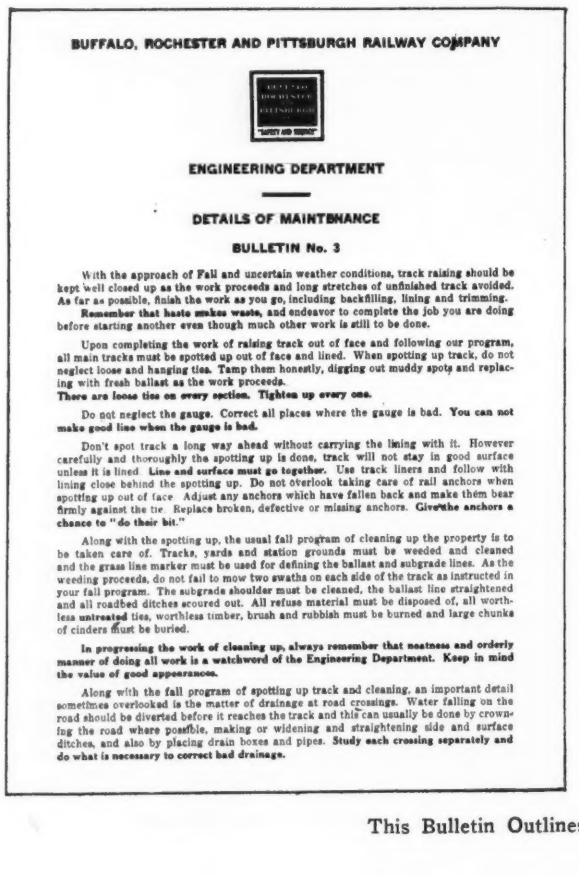
Be thorough in your repair work. Remember, a job worth doing is worth doing well.

During the fall months the lighting in and around all buildings, especially shops and engine houses, should be put in the best possible condition. Plug receptacle circuits are of equal importance with lighting circuits. See that panel box switches are in good shape and that handles are not missing, making it necessary for anyone operating the switches to take hold of the current carrying parts.

Be sure that all conduit systems and panel boxes are effectively grounded. **Thorough grounding of electrical equipment is the greatest safeguard to employes coming in contact with it.** A high standard in maintenance of lighting is important at all times, but especially so during the winter months.

Don't let the fact that there are several other jobs awaiting you induce you to neglect or leave your present job before it is fully completed. If taken away for other important or emergency work, go back and finish it.

When repairing heating plants in accordance with fall schedule of work, give thorough attention to the condition of heating plants in round houses and shop buildings, stoves, stove pipes, smoke jacks and other heating units to put them in safe and efficient condition before winter and paint them in accordance with our usual practice. Do not overlook the necessity for shutting off water from exposed lines used only in the summer and which will be damaged by freezing. **Remember that putting these facilities in first-class condition in the fall will save a lot of trouble during the winter.**



BUFFALO, ROCHESTER AND PITTSBURGH RAILWAY COMPANY

ENGINEERING DEPARTMENT

DETAILS OF MAINTENANCE

BULLETIN No. 3

With the approach of Fall and uncertain weather conditions, track raising should be kept well closed up as the work proceeds and long stretches of unfinished track avoided. As far as possible, finish the work as you go, including backfilling, lining and trimming.

Remember that haste makes waste, and endeavor to complete the job you are doing before starting another even though much other work is still to be done.

Upon completing the work of raising track out of face and following our program, all main tracks must be spotted up out of face and lined. When spotting up track, do not neglect loose and hanging ties. Tamp them honestly, digging out muddy spots and replacing with fresh ballast as the work proceeds.
There are loose ties on every section. Tighten up every one.

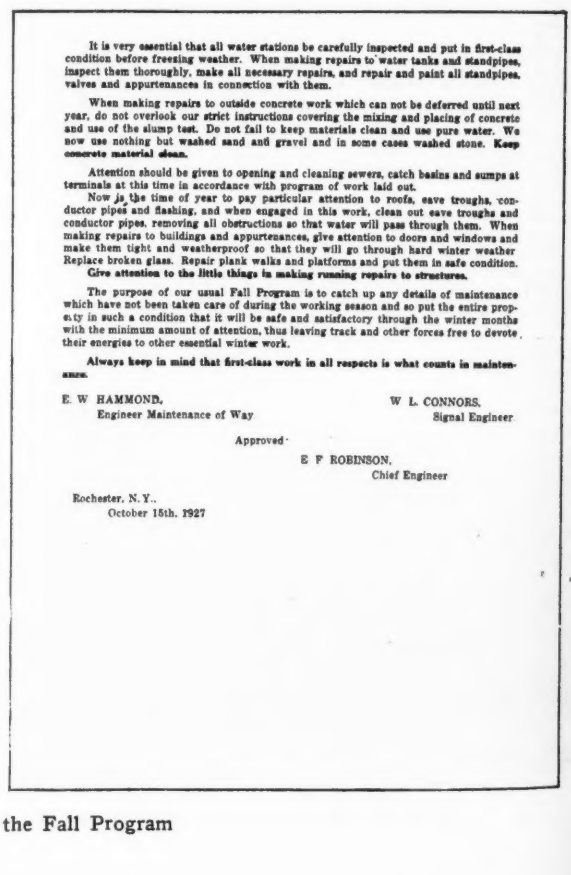
Do not neglect the gauge. Correct all places where the gauge is bad. **You can not make good line when the gauge is bad.**

Don't spot track a long way ahead without carrying the lining with it. However carefully and thoroughly the spotting up is done, track will not stay in good surface unless it is lined. **Line and surface must go together.** Use track liners and follow with lining close behind the spotting up. Do not overlook taking care of rail anchors when spotting up out of face. Adjust any anchors which have fallen back and make them bear firmly against the tie. Replace broken, defective or missing anchors. **Give the anchors a chance to "do their bit."**

Along with the spotting up, the usual fall program of cleaning up the property is to be taken care of. Tracks, yards and station grounds must be weeded and cleaned and the grass line marker must be used for defining the ballast and subgrade lines. As the weeding proceeds, do not fail to mow two swaths on each side of the track as instructed in your fall program. The subgrade shoulder must be cleaned, the ballast line straightened and all roadbed ditches scoured out. All refuse material must be disposed of, all worthless **untreated** ties, worthless timber, brush and rubbish must be burned and large chunks of cinders must be buried.

In progressing the work of cleaning up, always remember that neatness and orderly manner of doing all work is a watchword of the Engineering Department. Keep in mind the value of good appearances.

Along with the fall program of spotting up track and cleaning, an important detail sometimes overlooked is the matter of drainage at road crossings. Water falling on the road should be diverted before it reaches the track and this can usually be done by crowning the road where possible, making or widening and straightening side and surface ditches, and also by placing drain boxes and pipes. **Study each crossing separately and do what is necessary to correct bad drainage.**



It is very essential that all water stations be carefully inspected and put in first-class condition before freezing weather. When making repairs to water tanks and standpipes, inspect them thoroughly, make all necessary repairs, and repair and paint all standpipes, valves and appurtenances in connection with them.

When making repairs to outside concrete work which can not be deferred until next year, do not overlook our strict instructions covering the mixing and placing of concrete and use of the slump test. Do not fail to keep materials clean and use pure water. We now use nothing but washed sand and gravel and in some cases washed stone. **Keep concrete material clean.**

Attention should be given to opening and cleaning sewers, catch basins and sumps at terminals at this time in accordance with program of work laid out.

Now is the time of year to pay particular attention to roofs, eave troughs, conductor pipes and flashing, and when engaged in this work, clean out eave troughs and conductor pipes, removing all obstructions so that water will pass through them. When making repairs to buildings and appurtenances, give attention to doors and windows and make them tight and weatherproof so that they will go through hard winter weather. Replace broken glass. Repair plank walks and platforms and put them in safe condition.
Give attention to the little things in making running repairs to structures.

The purpose of our usual Fall Program is to catch up any details of maintenance which have not been taken care of during the working season and so put the entire property in such a condition that it will be safe and satisfactory through the winter months with the minimum amount of attention, thus leaving track and other forces free to devote their energies to other essential winter work.

Always keep in mind that first-class work in all respects is what counts in maintenance.

E. W. HAMMOND,
Engineer Maintenance of Way.

W. L. CONNORS,
Signal Engineer.

Approved:

E. F. ROBINSON,
Chief Engineer.

Rochester, N. Y.,
October 15th, 1927.

This Bulletin Outlines the Fall Program

by the fact that the B. R. & P. finds much constructive work to be carried on by these forces during the colder months. This is so well expressed in the bulletin that it seems worth while to repeat the closing paragraph, which reads as follows: "The purpose of the usual fall program is to catch up any details of maintenance which have not been taken care of during the working season and so put the entire property in such a condition that it will be safe and satisfactory through the winter months with the minimum amount of attention, thus leaving track and other forces free to devote their energies to other essential winter work."

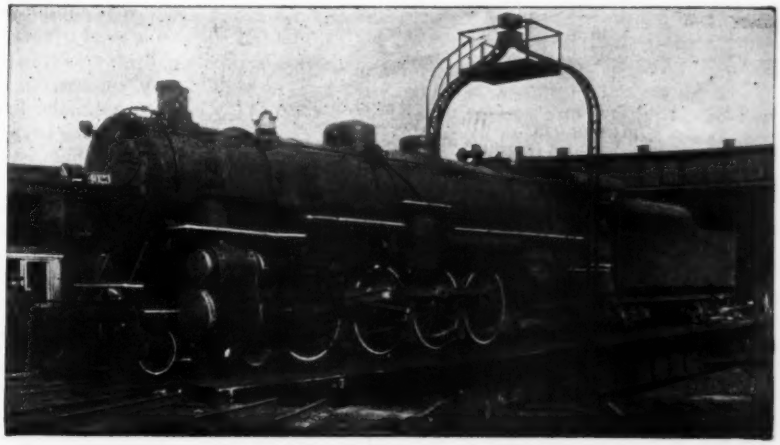
Rapid Curing Cement Aids Turntable Renewal

THE USE OF early high-strength cement in the concrete required to change the center footing and circle wall was an important element in the renewal of the turntable of the Chicago, Rock Island & Pacific at Herington, Kan. Unlike most projects of this kind, the new table is exactly the same length as the one it replaced, but differences in design, the new one being of the three-point-support type, made it necessary to raise the center footing and lower the circle rail to fit the new turntable. This necessarily entailed considerable concrete work, and as it was not deemed practicable, under the circumstances, to carry this out by means of precast units that could be set during the change of tables, it was necessary to build the new concrete in place during this operation. Consequently the time that the turntable was out of service was fixed by the period required for the concrete to acquire the strength necessary for the service demanded. Fortunately a way was available on which engines could be turned while the turntable was out of service, but in order to reduce the time to a minimum Quikard cement, an early-high-strength cement manufactured by the Ash Grove Lime & Portland Cement Company, Kansas City, Mo., was used in making the concrete.

No work was started until the new table and all necessary material were on hand. The new table was erected and the electrical equipment was installed on it at a location immediately adjacent to the pit. Before the old table was taken out of service, the concrete under the old circle rail was removed and the circle rail carried on blocking. This concrete was removed by drilling with air drills and blasting with small charges of dynamite to avoid damage to the turntable.

Concrete Was Subjected to Load in 30 Hours

At 7 p. m. on a Friday, the roundhouse forces moved all engines out and the old table was jacked up and pulled out of the pit. The gangs immediately started preparing the circle rail bed, setting reinforcing bars, forms and anchor bolts, and preparing the center for the new concrete. On Sunday the pouring of the concrete was started and all concrete was poured by 4 p. m. On Monday morning the new table was moved into place on rollers and blocking, the new deck was completed, and the electrical wiring was finished. Turntable service was restored at 10 a. m. on Tuesday. Thus, the concrete made of the rapid-curing cement was subjected to full load about thirty hours after it had been placed, whereas with the use of the ordinary portland cement the interruption by this work would have been materially greater.



The New Turntable in Operation

We are indebted to C. C. Cunningham, division engineer, Chicago, Rock Island & Pacific, Herington, Kan., for the information from which the foregoing description of the work was prepared.

Four-Track Bridge of the C. M. St. P. & P. over Marshall Boulevard, St. Paul, Minn.

How to Lay Out Batter Posts Correctly*

By J. Butler

Carpenter Foreman, Buffalo Division, New York Central

A BENT in a frame trestle is composed of a cap, a sill, two batter posts and two or more plumb posts. The length of the plumb posts is the straight distance between the bottom of the cap and the top of the sill, but the laying out of the batter posts is a real problem for the carpenter. The old methods of making a pattern or stepping off with a steel square are too slow and too inaccurate.

The table below gives the usual batters that may be encountered in trestle work. Ordinarily a 2½-in. or 3-in. batter is used in new work if conditions will permit,

Batter in inches to the foot	Gain in the length of batter posts: For each foot of plumb post	Gain in the length of batter posts: For inches of plumb post	Amount to deduct if post is over 24 ft. long
1	1/24 in.		
1¼	1/16 in.		
1½	3/32 in.		
1¾	1/8 in.	1/32 in. for 3 in.	
2	2/12 in.	1/24 in. for 3 in.	
2¼	7/32 in.	1/16 in. for 3 in.	
2½	¼ in., plus 1/32 in. for each 4 ft.	1/16 in. for 3 in.	
2¾	5/16 in.	1/32 in. for each inch	
3	3/8 in.	1/32 in. for each inch	⅜ in.
3¼	7/16 in.	1/24 in. for each inch	
3½	1/2 in.	1/24 in. for each inch	¼ in.
4	21/32 in.	7/32 in. for 4 in.	
5	1 in.	1/12 in. for each inch	

but sometimes, in order to have the batter posts stand over piles when a pile bent is cut off to be replaced by a timber bent, different batters may have to be given to the posts.

The 3-in. batter may be taken to work out a typical example. Lay out one end of the timber with a steel square, using 3 in. on one arm and 12 in. on the other and keeping the points 3 and 12 on the same edge of the timber. Mark the bevel cut across the timber on the 3-in. arm and square down both sides from the mark drawn.

Table Shows Gains in Length of Batter Posts

The table shows that the gain in length of the 3-in. batter post is ⅜ in. for every foot of length of the plumb post. Suppose the plumb post is 12 ft. 9 in. long. Then ⅜ in. per ft. for 12 ft. would be 4½ ft. The table also shows that the gain for each inch is 1/32 in., so for the 9 in., it would be 9/32 in., making in all, 4 25/32 in. that the batter post would be longer than the plumb post.† Adding 4 25/32 in. to 12 ft. 9 in. gives a length for the batter post of 13 ft. 1 25/32 in. Measure off this distance on the length of the stick and then lay out the bevel cut the same as before, taking care that the bevel is in the same direction as the bevel on the other end. This finishes the batter post as far as length and cuts are concerned. The spacing of the posts, if it is new work, is usually shown on the plan.

This method may be hard to learn for the man has no aptitude for figures, but it may be applied with the use of the steel square without doing any figuring. Count up on the square, ⅜ in. for each foot of the length of the plumb post and in this case you will have 4½ in. for the 12 ft. Now count 1/32 in. for the extra 9 in. and you have 9/32 in. Add this to the 4½ in. (or 4 16/32 in.) and it gives 4 25/32 in., the same as before, which is the figure to be added to the length of the plumb post. If you haven't a square or a rule that has thirty-seconds on it, take a sixteenth for each 2 in. A man who is not good at figuring may find that it takes some time to learn this method, but he should not be discouraged. I have taught men to become good trestle framers who could not read or write.

Corrections Must Be Made in Certain Cases

The figures given in the second column of the table give accurate results for all lengths of batter posts except for the three-inch and four-inch batters. In the case of these, as shown in the fourth column, it is necessary to deduct a small amount for posts longer than 24 ft. I wish to call particular attention to the figures for the 2½-in. batter. This batter is the only one that cannot be reduced to the fractions to be found on a steel square. For the 2½-in. batter, make a ¼-in. gain for each foot of length, but for each 4 ft. add 1/32 in. more. For example, with a plumb post 12 ft. 9 in. long, the length of batter for the 12 ft. would be 12 quarters or 3 in. For each extra inch it would be 1/48 in. but as there are no forty-eighths on a steel square, use 1/16 for each 3 in., which makes 3/16 for 9 in. The total length of the batter post is now 13 ft. and 3/16 in., to which must be added 1/32 in. for each 4 ft. of plumb post, or 3/32 in. The finished batter post is therefore 13 ft. and 9/32 in. in length.

It may seem like splitting hairs to work to such close measurements on rough timber, but it is only when the timbers are framed accurately that we can develop their full strength. For the 2½-in. batter the exact fraction, for the gain in each foot of length, is thirteen-fiftieths of an inch, but as this is an awkward figure to use, I have given the ¼-in. method which any one can figure in his head without using a pencil.

*Adapted from an article appearing in the August issue of the New York Central Magazine.

†As it is almost impossible to work closer than 1/16 of an inch in framing bridge timbers, it is unnecessary to make allowance for the extra inches in the length of the plumb post in determining the gain in length of batter posts, where the batter is 1½ in. to the foot or less, since if the gain is figured for the nearest foot of the length of the plumb post the error will not be more than 1/16 in.—*Editor.*

Use Strange Machines In Yard Grading Work

GRADING equipment of an unusual character was used recently in the construction of a yard for the Southern Pacific at Fresno, Cal.; in fact only two units employed, a Koehring shovel and a dragline of the same make, were of a conventional nature, and even these departed from the more ordinary type in that they were operated by 110-hp. Diesel engines. The yard occupies a strip of ground two miles long by 700 ft. wide adjoining the main track of the Southern Pacific two miles north of Fresno, and now consists of 15 tracks but will eventually be increased to a total of 32 tracks. Preparation of the site required 239,000 cu. yd. of grading, much of which was in hardpan with cuts to a maximum depth of eight feet and fills up to five feet in height. Of the total volume in excavation, 150,000 cu. yd. was moved in excess of ½ mile and a considerable quantity was moved 1¼ miles. On the other hand, part of the work entailed leveling operations involving little change in elevation and only moderate hauls.

In addition to the shovel and the dragline, the equipment included five two-wheel dump carts with a capacity of 12 to 14 cu. yd. of material which were employed in the hauling of the shovel excavation. There were also four telescopic scrapers, known as hydraulically operated. The power is employed in the operation of a rack and pinion mechanism for the control of the pitch of the large scraper blade. At the beginning of the loading operation this blade is held at an angle of about 15 deg. with the horizontal and as the scraper is moved forward the angle of the blade is decreased until the blade is in a horizontal position when the machine is fully loaded. This operation is reversed to empty the scraper.

Diesel Engine Shovel Loading 14 Cu. Yd. Dump Carts

Kaiser-LaTourneau earth movers, with a capacity of 8 to 9 cu. yd. each, two scrapers of the gondola or Schmeiser type with a capacity of 5 cu. yd. and a heavy duty scarifier used for breaking up the hardpan for the scrapers. All of this equipment was handled by 13 Caterpillar "60" tractors, manufactured by the Caterpillar Tractor Company, San Leandro, Cal.

Dump Carts Have Wide-Tread Wheels

As seen in the photographs the dump carts are of an unusual appearance, with large wide-tread wheels and rear-dump, top-hung gates. The contractor had originally employed trucks for the long haul from the shovels but found that these carts handled the material at a considerable saving in cost. In addition to the unusually large loads carried by each cart, the wide tread wheels enables them to move over rougher ground than the trucks, and with a proposed substitution of crawler treads on these carts it is expected to increase their effectiveness so as to make them available for use on almost any condition of ground.

The Large Two-Wheeled Dump Carts Were Hauled by Caterpillar Tractors

The telescopic scrapers used were of two types, one electrically operated with current from a generator mounted on a Caterpillar tractor and the other

The work was done under contract by L. G. LaTourneau of San Francisco, Cal., who developed much of the special equipment used on the job. With the aid of this unusual complement of excavating machinery he was able to complete the grading in 90 days time, working two shifts daily except Sunday.

Dogs and Men

Did you ever know a dog to tackle a porcupine or a skunk more than once? You could hardly blame a hound for jumping one of those varmints the first time for he has no way of informing himself like we humans have and has to learn by experience. But once is enough.

Lots of us would be better off if we had as much sense, in that respect, as a dog. A great many of our mistakes could be prevented if we would reason ahead with our work, even if we have not had the opportunity to profit by some other fellow's example. But after we have made the mistake, we certainly ought to be smart enough to avoid making it a second time.

You would be surprised to know how many section foremen have to be taken to task over and over again for the same mistake. It is not unusual for the roadmaster to go on the ground with a foreman and instruct him how to do a certain piece of work and later find his instructions being disregarded, not only once but several times.

Let's see if we can determine why this is: It cannot be lack of intelligence, for if a man has enough ability to rise to the position of foreman, he is smart enough to know what is wanted after being shown.

In some few cases, this trouble is the result of the foreman thinking he has a better way of doing the work than that prescribed in his instructions. If your way is really better than the one you have been told to use, you can get permission to use it without disregarding instructions. Your superiors want your ideas and will adopt them if they meet conditions to the best advantage. But these ideas should be presented in the proper manner.

In the great majority of cases where instructions are disregarded, it is the result of indifference, lack of interest, shiftlessness, or some other similar malady, all more or less contagious, but against which, unfortunately we cannot quarantine.

Let's try to profit by what others have learned at considerable expense and mental anguish. Let's make an even greater effort to avoid making the same mistake more than once. Let's be sure that no one can accuse us of having less gray matter than the poor flea-bitten pooch that learns his lesson from one mistake.

Good Advice to the Foreman

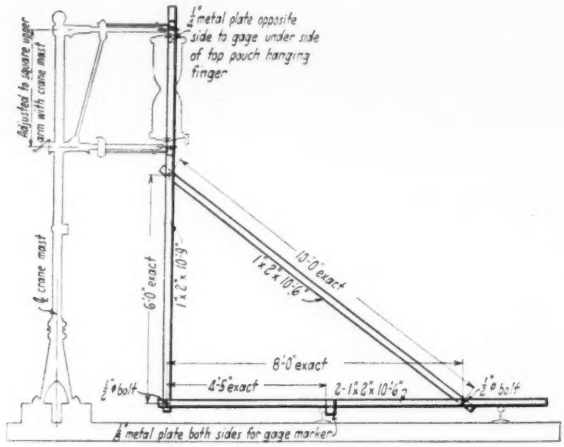
Another monthly bulletin from the Northern division of the Frisco

Gage for Setting and Testing Mail Cranes

By F. T. DARROW
Assistant Chief Engineer Chicago, Burlington & Quincy, Lines West of the Missouri River, Lincoln, Neb.

WE HAVE long felt the need for some simple means of making field tests of mail cranes to insure that their adjustment and position is such that the mail bags will hang in correct position for safe operation. To meet this need, a simple wooden gage has been developed which is furnished to master carpenters and bridge and building foremen who are required to inspect and examine mail cranes in connection with their work.

As shown in the illustration, the gage is of simple



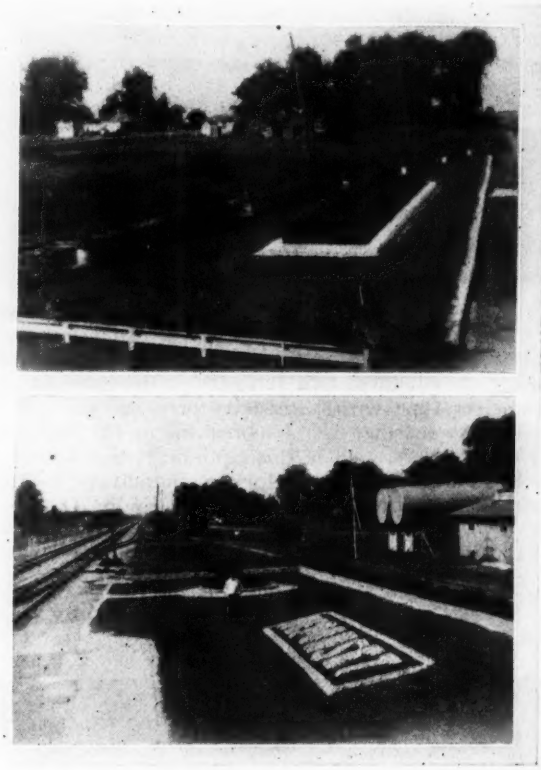
Drawing of the Mail Crane Gage

construction, consisting of four sticks of 1-in. by 2-in. lumber, held together by two ½-in. bolts and a tapered pin, and reinforced by a few small metal plates. It can be folded up so as to be handled easily on a motor car or carried in a tool box. Its use ordinarily demands the employment of two men.

Our instructions covering the inspection and testing of mail cranes provide that the section foremen shall inspect the cranes daily, bridge foremen shall make inspections monthly on main lines and every other month on branch lines, and that master carpenters shall inspect the cranes twice a year. Roadmasters are also required to observe the condition of the mail cranes in going over their territories.

What One Man Can Do

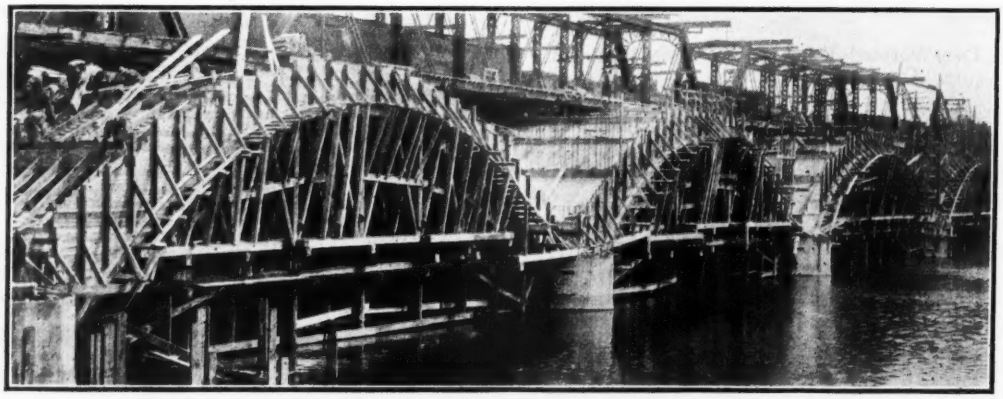
THE TWO views show the station grounds of the Chicago, Burlington & Quincy at Neponset, Ill., which have been beautified by a well-kept lawn and flower beds through the effort of one man, the second-trick operator. He received the encouragement of railway officers and occasionally had the help of other employees, but the results obtained are due primarily



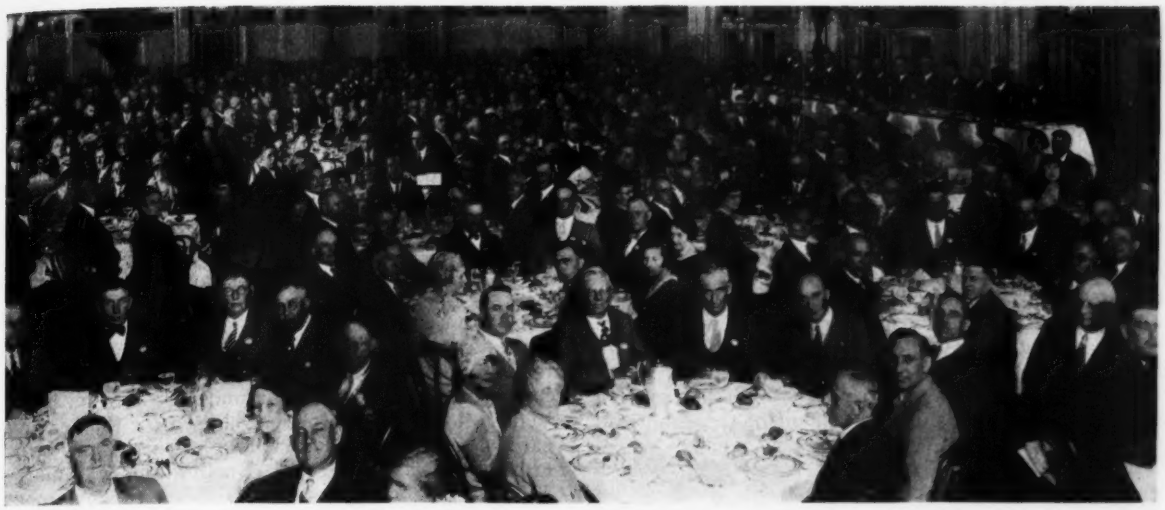
Two Views of the Station Grounds at Neponset

to his enthusiasm and the constant attention he gave to the lawn and flowers during his off-duty hours.

In addition to the lawn and formal flower beds, the decorative treatment includes gravel borders and walks, hedges and potted plants. We are indebted to R. L. Sims, district maintenance engineer, Galesburg, Ill., for the above information.



Concrete Form Work Gives Rise to a Large Demand for Lumber



Nearly 500 Persons Were Present at the Annual Dinner

Roadmasters Hold Convention at Detroit

Nearly 300 Officers of Track Maintenance Participate in Sessions of Forty-Sixth Annual Meeting

THAT THE time and energy of the roadmaster and supervisor of track are about equally divided between administrative duties and a careful study of the minute details of the methods employed by the forces under their direction is apparent from the list of subjects discussed at the forty-sixth annual convention of the Roadmasters' and Maintenance of Way Association, which was held at Detroit, Mich., on September 18, 19 and 20. Three committee reports, covering the programming of section work, the organization of track forces and the conservation of cars in handling materials, were clearly concerned with the administrative side of the roadmaster's work. On the other hand, the two other committee reports, namely, one on the care of winter-laid rail and another relating to the methods of preventing or overcoming damage to rail ends, are indicative of the more technical side of the maintenance officer's work.

Further attention to the general subject of rail was accorded in the paper by C. B. Bronson, assistant inspecting engineer, New York Central Lines, which was concerned with the manufacture and service of rails. The program was further diversified by a paper on the problems of maintaining a high speed railway, by J. F. Deimling, chief engineer of the Michigan Central, and a paper on the permanent track construction on the Pere Marquette, by Paul Chipman, valuation engineer, Pere Marquette, Detroit, Mich. Mr. Chipman's paper was supplemented not only by lantern slides but also by a visit to the quarter-mile installation of concrete roadbed on the Pere Marquette some 10 miles west of Detroit, during the course of an inspection trip in a special train furnished by that road on Thursday afternoon, following the close of the convention.

The convention was held under favorable auspices. The Book-Cadillac Hotel, where the convention was held, provided ample space on one floor for the various sessions of the convention, and for the exhibit of the Track Supply Association.

The registration, 465 members and guests, compared favorably with that in other years. The convention schedule included two sessions each on Tuesday and Wednesday and a session on Thursday morning, supplemented by an informal meeting on Tuesday evening and the annual dinner given the roadmasters by the Track Supply associations on Wednesday evening.

C. E. Hill Talks on Safety

The feature of the Tuesday evening meeting was an address by C. E. Hill, general safety agent of the New York Central, New York, supplemented by the showing of an educational safety moving picture film prepared under Mr. Hill's direction for the purpose of carrying the message of safety to men in the ranks. Mr. Hill devoted a portion of his remarks to an outline of three fundamentals of promotional work in safety, namely, (1), engineering or the perfection of tools and equipment to provide safe conditions, (2), safe practices and (3), education. However, he stressed, in particular, the important place that the casualties among maintenance of way employees occupy in the general accident record of the railroads. He directed particular attention to the fact that, of the 446 fatalities among maintenance of way employees during 1927, more than two-thirds were the consequence of men having been struck by locomotives or cars. Such accidents, he contended, were avoidable and the accident records of the railroads of the United States

during recent years show that many of them can be greatly improved. In fact, he said, the accident ratios of the various railroads are in large measure proportional to the efficiency of the safety work which they carry on.

The convention was called to order at 10 o'clock Tuesday morning, September 18, by President J. P. Davis, engineer maintenance of way, Central Indiana, Anderson, Ind., who presided over all of the sessions. The roadmasters were welcomed to Detroit by C. G. Bowker, general manager of the Grand Trunk Western, who paid a tribute to the officers of track maintenance, particularly those who have gained proficiency by learning the work "from the ground up." Supplementing Mr. Bowker's talk and introductory remarks by President Davis, the opening session was featured by the reading of a letter from R. H. Aishton, president of the American Railway Association, who has long taken an active interest in the Roadmasters' conventions but was unable to attend this year.

Mr. Aishton Sends Letter of Encouragement

Owing to his inability to be present at the convention because of a conflicting engagement, R. H. Aishton, president of the American Railway Association, sent a letter of greeting which was read at the opening session. This letter read in part as follows:

"With your help the railroads have, during another year, given the public adequate and efficient transportation service. It may be that the shipping public has become so adjusted to the high level of service rendered them by the carriers that they are beginning to take this service for granted without a full realization of the large capital expenditures and the effort on the part of all branches of the railroad operating service to achieve these results. The message should be carried to the public that the faithful servant is worthy of his hire and that adequate returns are essential to a continuance of such high-grade service.

"Competition with the rail carriers by other means of transportation—on the highway, in the air, on the water—continue to increase. No one yet has questioned the fact that the rail carriers are today and will continue for the foreseeable future to be the backbone of transportation in this country. In this competitive contest, however, the railroads will maintain their position by making their service the most attractive, the most economical and the most satisfactory to the shippers. We must run as fast as we can today in all ways that lead to more efficient and economical operation in order to maintain the supremacy in transportation which we have achieved."

Closing Business

The report of the secretary showed a membership in good standing of approximately 900, with 148 new members elected during the year. The treasurer reported a balance of approximately $4,100 on hand.

The following officers were chosen for the ensuing year: President, H. R. Clarke, general inspector permanent way, Chicago, Burlington & Quincy, Chicago; first vice-president, E. E. Crowley, roadmaster, Delaware & Hudson, Oneonta, N. Y.; second vice-president, Elmer T. Howson, editor *Railway Engineering and Maintenance*, Chicago; secretary, T. F. Donahoe; general supervisor of road, Baltimore & Ohio, Pittsburgh, Pa.; treasurer, James Sweeney, supervisor, Chicago & Eastern Illinois, Danville, Ill.; members of the executive committee: A. A. Johnson, engineer of track, Delaware, Lackawanna & Western, Hoboken, N. J. and P. J. McAndrews, roadmaster, Chicago & North Western, Sterling, Ill.

Chicago was selected as the location for the next convention, to be held on September 19-21, 1929.

The Committee on Subjects recommended the following topics for consideration and report by committees during the ensuing year: (1) The selection and training of section foremen. (2) Methods of determining and controlling crosstie and switch tie renewals. (3) Develop standards of good workmanship in laying rail and recommend methods of insuring adherence to these standards. (4) The detection and correction of unsafe methods in track work. (5) Methods and costs of weed control or elimination.

The Care of Winter-Laid Rail

REPORT OF COMMITTEE

THE ADVANTAGES to be gained by laying new rail in the winter, if this work can be done economically and well, are apparent to all familiar with maintenance problems. Are these benefits, especially on northern roads, greater than the handicaps imposed?

The principal reason for doing as much track work as possible during the cold season is because it assists materially in lightening and advancing the work of the following spring and summer; also a much more adequate and efficient labor supply is available; as many kinds of work are at a standstill, especially in the northern states, at this time of the year. Further, the traffic on most roads is considerably lighter at this season; consequently the work can be done with less interruption to traffic. The systematic scheduling of work during the winter months which can be done during that season, will permit a more evenly balanced force allowance to be maintained during the entire year. This is an important consideration as no condition detracts from the efficiency of the maintenance of way department more than a large turnover in men, much of which is brought about by the large reduction in forces on the approach of winter. A study of maintenance of way labor payrolls with respect to the influence of fluctuating labor requirements due to so-called seasonal work will indicate, in addition to the great fluctuation in the number of men employed, an excessive labor turnover; both the fluctuation in numbers and the turnover result in many inexperienced men being employed. As proof that the turnover will be greatly reduced by uniformity in forces, a study of payrolls will again show that men comprising the minimum force remain in service throughout the year with a very limited turnover.

Therefore, in consideration of the ultimate economy of building a strong personnel, and the immediate economy of holding experienced men in maintenance of way service, as much work as is economically possible, should be done in the winter, thus stabilizing forces.

Rail renewal is the most important item for winter

work. There are few places in the United States where rail cannot be relaid economically in the winter. Men work with more vigor then than during the summer, thus yielding a higher performance per man day; also, section gangs can be spared from other work at this season and can be bunched for the work.

In years gone by, it was generally thought by maintenance of way officers that laying rail in the winter months was detrimental to the life of the rail, and that rail should not be laid until late in the spring. Those officers who have gone into this subject extensively have been convinced that while there is certain economy in laying rail in the spring of the year, it is not sufficient to overcome the advantage of winter rail laying, with the resultant uniformity in forces and reduction in labor turnover. It is true that it is sometimes necessary to make some changes in the methods of laying rail in the winter to overcome the disadvantages. For this reason, the following procedure is recommended, in addition to the care that is exercised in laying rail in the summer months in getting proper expansion, bolting, tightening and following rail-laying closely with rail anchors, etc.

J. P. DAVIS
President

While most of the executive officers of the Roadmasters' association have been officers of trunk-line railways, in the election of Mr. Davis to the presidency a year ago, recognition has been given to the place occupied by the short lines in American transportation. Nevertheless, the railway career of President Davis has been that of the typical track-maintenance officer, and, like many other members of the association, his service as a railway man has been confined to one property, the Central Indiana. Appointed roadmaster in 1908, he was responsible for track maintenance on that property for 15 years, when his title was changed to engineer maintenance of way, in 1923, in recognition of the gradual broadening of his responsibilities. He has been a member of the Roadmasters' association since 1913 and after serving as a committee member and chairman, he was eleced a member of the executive committee in 1922, following which he was advanced, in 1925, to second vice-president and thereafter to first vice-president and president respectively.

Special Precautions

Early in the fall, previous to installing new rail, revised rail charts should be furnished by the maintenance engineer, showing the locations where new rail is to be laid. If rail is to be laid where track is ballasted with cinders or gravel, the ballast should be removed before the ground freezes, to permit the adzing of ties and the rolling of the rail if necessary, and to make it possible to apply rail anchors.

The scoring of ties should be done late in the fall before the snow flies. The most efficient and practical method of scoring ties is by means of a machine, for such a device possesses a great advantage over hand scoring as saws can be set to cut the exact depth and length that ties are to be scored. When hand scoring is done, a great deal of unnecessary adzing is often done, which shortens the life of the ties.

If the ground is frozen by the time the new rail is received, considerable care must be exercised in unloading to see that it is not damaged by striking the ground too severely. This can be accomplished by unloading it from flat or open top cars with rail loaders, power rail layers or cranes. Where locomotives are used in connection with steam cranes for loading, unloading and laying rail, it has been found advantageous to equip a locomotive with steam pipes for the purpose of thawing out snow and ice. When preparing for the laying of rail immediately, if much snow is expected, spikes, bolts, angle bars, tie plugs and rail anchors should not be distributed too far in advance.

When a locomotive crane is used to pull out the old rail and set in the new, the presence of frost in the ground is an advantage, as there is then no danger of disturbing the ties. This work will require considerably more care when handled with a steam crane in the summer when the ties are loose, to avoid the possibility of loosening or disturbing them.

A gang of men should follow the rail laying to shim all loose ties; after rail has been laid, section forces should keep all uneven places shimmed. In the spring of the year when frost is leaving the ground, shims should be taken out as soon as possible and all uneven places surfaced.

Some of the members of this committee are employed on northern roads that have endeavored to lay all of their new rail during the winter season for several years and have been able to do so with few

exceptions, these failures being due to inability to obtain new rail in time to permit them to carry out the arranged program.

Conclusions

Opinions of the members of the committee differ as to the cost and quality of winter rail laying but those who have gone into the matter thoroughly are satisfied that both of these factors compare favorably with work done during the summer. Others feel that while the cost in some locations may be somewhat higher in the winter, the small increase is more than offset by the advantages gained, which may be summarized as follows:

(1)—Less delay in work and interruption to traffic.

(2)—Stabilization of forces, resulting in decreased labor turnover and retention of experienced men.

(3)—Any work now considered as summer work which can be transferred to the winter will permit the earlier completion of work incidental to the rail laying program.

(4)—Productive work is provided for forces that must be retained, with experienced forces available for emergency work and better morale because of continuous employment.

Committee: M. J. Nugent, chairman, assistant engineer, D. & H., Albany, N. Y.; A. Chinn, engineer maintenance of way, C. B. & Q., Lincoln, Neb.; J. P. Corcoran, roadmaster, C. & A., Bloomington, Ill.; W. F. Nichols, supervisor, L. V., Buffalo, N. Y.; G. H. Strople, supervisor, B. & O., Callery, Pa.; C. W. Coil, roadmaster, N. P., Fargo, N. D.; J. W Powers, supervisor N Y. C., Rochester, N. Y.; and W. A. Davidson, roadmaster, U. P., Kearney, Neb.

Discussion

The discussion of this report was directed more towards the wisdom of laying rail in winter than to the specific subject of the report—the care of rails actually laid in winter—although most of the points raised had a definite bearing on the effect of winter laying on the rail itself. In reply to a question regarding the possibility of making adequate allowance for expansion in the winter, J. W. Powers (N.Y.C.), D. Vallier (B.&M.) and G. H. Strople (B.&O.) reported that they had encountered no difficulty on that score. In answering a question from I. D. Talmadge (N.Y.O.&W.), Mr. Vallier said that he had noticed no particular tendency of ties to split from the driving of spikes in freezing weather. Mr. Strople called attention to the necessity of completing the work thoroughly on the stretch of rail relaid each day—full spiking and bolting and applying rail anchors and also shims, where necessary.

P. J. McAndrews (C.&N.W.) said that, other things being equal, he favored the laying of rail in winter as a matter of principle, but he called attention to the particular conditions prevailing on the Chicago & North Western. Traffic, he said, is much heavier on that road in winter than in summer; consequently winter work will interfere with train movements more than summer work.

M. Donahoe (C.&A.) contended that winter-laid rail will be end-battered more than summer-laid rail because it is exposed to the condition of wide expansion gaps before the running surface of the head has been case-hardened by service. C. P. Richmond (N.Y.N.H.&H.) took issue with this theory, contending that surface temper is acquired only after several years of cold rolling in service, so that a few months use after summer laying will make little difference in the effect of wide joints in winter.

A. M. Clough (N.Y.C.) advocated winter laying, stating that, in his experience, no rail laid in winter, in track that had been well maintained, had been injured. T. Thompson (A.T.&S.F.), on the other hand, reported unfavorable results.

H. P. Stafford (D.S.S.&A.) and C. W. Baldridge (A.T.&S.F.) pointed out that the securing of good line and surfacing on rail laid after the ballast was frozen required spike lining and shimming, and that both of these practices were expensive and harmful. W. Rambo (M.P.) favored the laying of rail at any time that he could get it, but B. C. Dougherty (C.M.St.P.&P.) presented extended arguments against winter laying in latitudes where winters are severe, on the grounds of greater cost, inferior workmanship and increased hazards to traffic. His views were supported in part by J. B. Kelly (M.St.P.&S.S.M) and M. Donahoe (C.&A.).

The Programming of Section Work

REPORT OF COMMITTEE

AMONG the outstanding developments in railway operation during the last few years has been the progress toward increased efficiency. The age of experiment in railway development has long since passed. The period of great railway expansion—of building new lines into virgin territory—is behind us. The present problem of railway management is to increase the capacity and efficiency of the existing plant—to make two blades of grass grow where one grew before.

The modern railroad is an intricate and highly organized mechanism. In order to function with the maximum efficiency, every department and every unit of that department must perform its particular task with clock-like precision. But, unlike a mere machine, the railroad must undergo continual adjustment to meet constantly changing conditions. To attain the highest degree of efficiency and to insure the maximum economy in railway operations a great deal of the work must be carefully planned beforehand. This applies with particular emphasis to the departments which are charged with the maintenance of the roadway. The need of adopting and adhering to an intelligent working program in maintenance work is generally recognized.

Experience a Guide

The maintenance engineer, the roadmaster, the road supervisor and the track foreman are each in a position to render valuable aid in this direction. In mapping programs and formulating budgets for maintenance work, the maintenance man is guided largely by his own experience and by the practices of others in whose ability he has confidence. It is extremely doubtful if any person or group of persons could formulate a cut-and-dried program or budget that would be applicable or practicable in every case, owing to constantly changing conditions, as well as to the peculiar conditions or policies which obtain on different railroads. However, every person engaged in maintenance work should be

able to contribute some helpful suggestions toward effective planning and efficient practice.

For one thing, the tendency toward the use of heavier and more modern equipment, especially on the main-line divisions, is a factor which must constantly be borne in mind in efficient maintenance planning. We have all encountered numerous instances where heavy expeditures could have been avoided or postponed had future developments in this direction been anticipated.

The difficulties frequently experienced in obtaining from the management sufficent appropriations with which to carry on what seems to be necessary work is a problem that each one must work out for himself. It must be borne in mind that the management is entrusted with the task of operating the railroad in the most economical and efficient manner possible and that there are many demands upon the monthly allotment. The problem is to make the most of one's allowance, whatever it may be. This calls for the most careful planning, not only for the current month but for several months in advance.

H. R. Clarke
First Vice-President

T. F. Donahoe
Secretary

Roadmasters' Association Officers, 1927-1928

J. P. DAVIS, President, Engineer Maintenance of Way, Central Indiana, Anderson, Ind.

H. R. CLARKE, First Vice-President, Gen. Insp. Permanent Way, C. B. & Q., Chicago.

E. E. CROWLEY, Second Vice-President, Roadmaster, D. & H., Oneonta, N. Y.

T. F. DONAHOE, Secretary, General Supervisor, B. & O., Pittsburgh, Pa.

JAMES SWEENEY, Treasurer, Supervisor, C. & E. I., Danville, Ill.

Executive Committee

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ELMER T. HOWSON, Honorary Member, Editor, *Railway Engineering and Maintenance*, Chicago.

(Terms Expire September, 1931)

E. C. BUHRER, Supervisor, N. Y. C. Lines, Kenton, Ohio.

M. DONAHOE, General Supervisor of Maintenance, C. & A., Chicago.

(Terms Expire September, 1930)

A. E. PREBLE, Supervisor, Pennsylvania, Middletown, Pa.

F. J. MEYERS, Assistant Engineer, N. Y., O. & W., Middletown, N. Y.

(Terms Expire September, 1929)

C. J. COON, Assistant Engineer, N. Y. C., New York City.

J. J. DESMOND, Roadmaster, I. C., Chicago.

(Terms Expire September, 1928)

P. J. McANDREWS, Roadmaster, C. & N. W., Sterling, Ill.

C. W. BALDRIDGE, Assistant Engineer, A., T. & S. F., Chicago.

E. E. Crowley
Second Vice-President

James Sweeney
Treasurer

Advantages of Careful Planning

A well-formulated plan brings the work under full control of the supervisor and section foreman. Their ingenuity is taxed to show their superior officers how the maintenance allotment can best be distributed. The budget system impresses the supervisors and foreman with the importance of adhering to a set program. It also gives them a better understanding of the season's work and the assurance that the schedule will be completed in an efficient manner if the force is allowed in line with recommendations which should reasonably set up the actual requirements, as the labor costs run high at best and all must know that the situation is properly handled.

It is good practice, after the winter has passed and before starting into the working season, to give the roadway a general spring cleaning. By so doing, the premises will present a neat appearance. This gives the foreman and the men an incentive to go ahead with their general work under the best possible conditions. The efficiency of a foreman is judged in some degree by the appearance of his section. Proper policing and general neatness usually reduce the number of small tasks required during the heavy working season and avoid the constant changing from one line of work to another, permitting the foreman to show better results in the performance of his work.

In laying out the season's work on each section, it is a common practice, and a good one, to start two foremen at work at the same point, each working away from the other on his own section, thereby establishing long stretches of finished work early in the season. Each foreman should confer with his supervisor upon the number of ties to be removed, the ties having been previously counted by the supervisor and section foreman. Before starting the general surfacing work, a definite plan should also be agreed upon as to where and how much the track is to be raised. The best

method of securing this information is for both the supervisor and section foreman to walk over the track to ascertain the true condition of the territory to be worked. At the same time, the need for track fastenings, ballast, drainage and so on should be determined. Special care should be given the question of proper drainage. The side ditches should be opened up early in the season to insure adequate drainage of the track structure. All these facts are necessary in order to arrange an intelligent season's program.

One of the best method of keeping an accurate, convenient and up-to-date record of track conditions is to require each foreman to submit a daily report showing the amount of track surfaced each day. The supervisor will be greatly aided by a progress chart which shows the maintenance program, including the amount of rail to be laid, the number of ties to be installed, the light and heavy surfacings and so on. This information, as well as the progress made, may be shown on the chart in colors. Charts should be kept by both the roadmaster and the supervisor, the roadmaster's chart being posted frequently from the supervisor's charts. An extra copy of the roadmaster's chart may be kept for his information when discussing the work on his division with superior officers. By this method the supervisor can keep in constant touch with the situation and assist the roadmaster in seeing that the season's schedule is being properly adhered to. The chart method enables both the supervisor and roadmaster to keep constantly informed of track conditions and reveals the weak spots in the organization. Some foremen are prone to permit interferences to check their progress and retard the developing of the set program. In order to overcome this situation, there is need for constant checking by the supervisor. He knows the foremen who are making the poor showings and he knows where the situation must be remedied.

One of the important duties of the supervisor is to see that sufficient material is at hand to take care of the section foreman's requirements. Occasionally there may be unavoidable delays due to shortage of materials, but if the foreman knows the work which has been mapped out for him, he will be better able to anticipate his needs well in advance and avoid the necessity of wiring the supervisor that he is "Out of work waiting for material." It goes without saying that co-operation with the heads of other departments is essential; in fact, nothing can be accomplished without it.

Checking Tie Renewals

In placing new ties, in track care should be taken to see that those having the greatest mechanical strength are placed where traffic and wear are the heaviest. The proper seating of rail upon the ties is a feature which should not be overlooked. Careful adzing of ties should be watched closely by the foreman. Rail properly laid and cared for in the right manner will greatly increase the life of ties. The largest expenditure for any class of material used in the maintenance of way department is for ties; and since most railroads now use creosoted ties, the initial cost is much greater than it would be if untreated ties were used. Therefore, economy demands that the full service of a tie be secured before it is removed from the track. The renewal of ties has been carefully scrutinized, and most railroads now keep a record of those renewed on each mile of track each year. A comparative statement of this kind is an important aid in checking the renewal of ties, and supervisors should see that section foremen are given this information.

By following a standard plan for spacing ties covering various kinds of track, such as high-speed main line, branch lines, low-speed freight tracks, yard running tracks, leads, passing tracks, etc., the ties will be spaced to meet the particular conditions they are to serve. Proper spacing instructions should be given to the man on the ground so that the requirements of the traffic will be met and the greatest economy can be effected. By adhering to set rules in the spacing of ties the season's requirements can be more accurately determined beforehand.

Salvaging Scrap Materials

Ties removed from track should be carefully inspected. Those which can be used for sidings, yards, repair tracks, etc., should be segregated and made ready for movement whenever needed. Those which can be used for engine wood or other fuel purposes should be handled in a similar manner.

We have long used the word "scrap" and should know what it means. It is important that the foremen shall closely inspect all materials released before assigning it to scrap. Frequently serviceable material is placed in scrap piles on account of lack of education on the part of the foremen. Therefore, it is important that supervisors thoroughly familiarize themselves with the proper classification of materials removed and issue instructions to section foremen which will insure their proper disposal. By gathering up the released materials each night and unloading them at the tool houses where the material bins are located, the foremen are able to sort the materials in a manner that will insure against the consignment of serviceable road department material to the scrap boxes. In this way the hauling of serviceable material long distances to the store department's general scrap dock will be prevented and the possibility of the other fellow reclaiming and returning it to the line of road to be used again will be avoided.

Efficiency Increased by Budgeting

Upon the maintenance of way department rests the responsibility of keeping the track in condition to enable the operating department to maintain uninterrupted passenger and freight movements. General efficiency demands that slow orders and other interference due to track maintenance should be reduced to a minimum.

The greatest efficiency can be attained and objectionable features can be reduced to the minimum if the roadmaster, the supervisor and the section foreman will confer frequently, plan carefully and adhere as closely as possible to a carefully prepared seasonal program.

By avoiding haphazard methods in ordering materials and labor, many of our difficulties will be overcome and greater efficiency will undoubtedly result.

Committee: J. J. Desmond, chairman, roadmaster, I. C., Chicago; G. T. Anderson, roadmaster, K. C. S., Heavener, Okla.; P. J. Keenan, supervisor, Erie, Cuba, N. Y.; A. Salinsky, roadmaster, B. R. & P., Salamanca, N. Y.; T. R. Patterson, roadmaster, M., St. P. & S. S. M., Superior, Wis.; P. Chicoine, roadmaster, C. P. R., Smiths Falls, Ont.; F. W. Easton, roadmaster, S. P., Ogden, Utah; and C. Feucht, roadmaster, U. P., Kansas City, Kan.

Discussion

The active discussion of this subject indicated the increasing interest that maintenance of way officers are taking in the programming of track work. A representative of the Hocking Valley described an experiment that was undertaken on that road last spring with the programming on an annual basis of the work to be done on several sections. To do this a complete inventory was made of the work to be done on each ten rail lengths of line. Work orders are then

issued to the gangs prior to the beginning of each task, and as the work is done its progress is compared with the estimate. This program is flexible in that the work is divided into three classes, according to the degree of its necessity.

C. H. R. Howe (C.&O.) stated that his road and the Hocking Valley operate on annual budgets which, after being approved, are not interfered with by the management. Under this plan each supervisor receives a monthly allotment in keeping with the program. This caused numerous roadmasters to express doubt regarding the possibility of preparing programs that could be adhered to with reasonable accuracy throughout the year on their roads. Among these, P. J. McAndrews (C.&N.W.) emphasized the necessity of meeting changing conditions arising from floods, etc., as they occur and for this reason favored a monthly rather than an annual budget. At the same time he emphasized the necessity for some kind of a program.

In reply to a question regarding the tangible beneficial results from programming, Chairman Desmond stated that his road had found this plan an incentive to industry, by keeping definitely before the forces the work to be done. It has also been found that a program affords a measure of progress.

W. Shea (C.M.St.P.&P.) cited the practice of his road in scheduling rail laying and ballasting operations for the entire year on a system basis. By reason of the success attending the application of a systematic program to these operations, he advocated the scheduling of section work. "Such work," he said, "is just as seasonal as farming and there is some time in which every operation can be done more economically than at any other time. For this reason we need a well defined program for section work as we now have for rail laying and ballasting. The most pressing problem confronting maintenance of way officers of today," he said, "is to secure the same efficiency from section forces as from extra gangs."

Permanent Track Construction on the Pere Marquette

By PAUL CHIPMAN

Valuation Engineer, Pere Marquette, Detroit, Mich

THE CHIEF purpose of nearly all track improvements is to distribute the wheel-load over a greater area of the sub-grade. To this end we increase the depth of ballast and put in more ties per rail. But the workable limit of spacing ties is soon reached, while two feet of ballast will distribute the load on each tie to the sub-grade with practical uniformity, so that little is gained by any greater depth of ballast. However, at any particular instant certain ties are directly under the wheels and carry more of the load than those on either side. In an attempt to equalize this load, heavier rail is installed; but the indications are that the limit has about been reached in this direction also. Assuming, however, the use of a rail heavy enough to give an approximately equal load on all ties, the problem is only half solved, for the sub-grade does not give uniform support to the loads imposed upon it. Mother Earth is a fickle dame, now hard and resisting, now soft and yielding. Further, it is common knowledge that her behavior in this respect depends largely upon how much she has had to drink. In fact, her habit of absorbing liquids causes us a lot of trouble and there is no hope of her reform.

Limitations of Present Construction

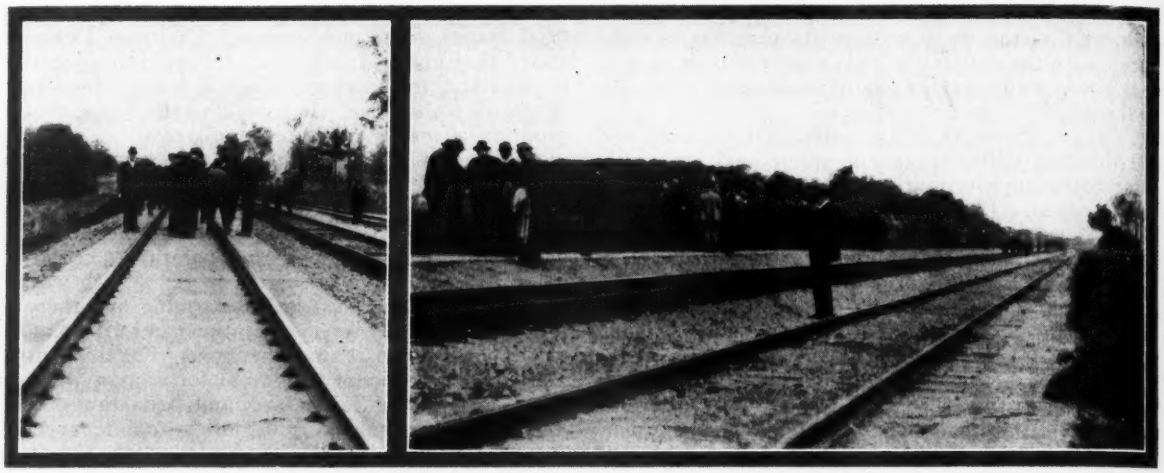
Now, it is evident that the present type of track has its limitations in the way of securing equal support for the loads. With an axle load of 60,000 lb. and 50 per cent allowance for impact, the pressure on the bottom of the ties directly under the drivers is about three tons per square foot, and with two feet of ballast, this is spread out and reduced to about one ton per square foot by the time it reaches the sub-grade. This is not an excessive load, even for soft soils, where the load is static, as in the case of buildings; but in the case of track, the load is applied many times every day and a load frequently applied causes more settlement than a static load. This is indicated by our own experiment, as will be shown later. Furthermore, uneven tamping, loose joints, soft ties and numerous other factors, but above all, unequal support by the sub-grade, all result in higher unit pressures than the average.

It is also evident that the frequent and continued applications of loads that approach the average supporting power of the sub-grade are going to exceed the actual supporting power in a great many more places than if the loads were lighter. A pressure of one ton per square foot will develop a great many more soft spots than a pressure of ½ ton.

Are we not, therefore, justified in seeking a new type of track structure that will reduce and equalize the bearing on the sub-grade to the greatest extent possible? This is exactly what we have been trying to do with the present type of track; but we have reached the limit, except possibly in the matter of rail. As traffic increases, the only alternative to track improvement is greater labor expense. The proper balancing of these two elements is a problem that calls for the best judgment of the maintenance engineer. The amount that should be spent for either track improvement or track maintenance depends on the amount and nature of the traffic and no departure from the present type would be justified where traffic is light, or only moderately heavy. But the time has now arrived when roads with heavy traffic divisions may well afford to consider the possibility of developing some other form of track that will be better adapted to heavy traffic conditions. That many of them are doing so is indicated by the interest that has been shown in the Pere Marquette's experiment.

Advantages of Reinforced Concrete

To distribute the wheel-loads over the greatest area of the sub-grade necessitates the use of a continuous slab, constructed of material that is not only strong enough to distribute the load, but also low enough in cost to make its use economically possible. Reinforced concrete is the only material that combines these essential requirements. The use of a reinforced concrete slab implies a rigid roadbed. We have been so long accustomd to a track that has more or less flexibility that this feature has come to be regarded by many as a necessity. But is not a smooth and rigid track better than a rough and flexible one? If a



The Roadmasters Inspected the Concrete Roadbed on Thursday Afternoon

track can be made both rigid and smooth, there will be no shocks to be absorbed and therefore no occasion for flexibility.

In addition to doing away with ballast and ties, there are other advantages of a slab which affords continuous support for the rail. The rail wave is practically eliminated; although not absolutely so, as a weight as great as that of a locomotive cannot be placed upon any structure without causing some slight deflection. With elimination of the rail wave, joint trouble disappears. The rail no longer has to span from tie to tie and can be made as light as the requirements for wear of the head and bearing for the base will permit. As tensile stress is practically eliminated, harder rail can be used, thus greatly reducing rail wear.

Was Completed in November, 1926

The Pere Marquette's experimental structure was installed in November, 1926, and operation began on December 19 of that year. It is 1,326 ft. long and located on the west bound main track at Beech station, about 12 miles from down town Detroit. This location was chosen because of convenience for frequent observation. The slab consists of 34 sections, each 39 ft. long. It is 10 ft. wide and 21 in. thick. In addition to ordinary reinforcing bars, a light steel truss is imbedded in the concrete directly beneath each rail. The upper chord of this truss consists of two ¼ in. by 4 in. steel plates placed vertically with the upper edge slightly below the surface of the concrete. These trusses are connected with each other at intervals by brace frames and adjustable tie rods. Attached to the steel plates at proper intervals are steel stirrups, which afford a means of attaching the rail fastenings. The rails are held in place by clips which are bolted to these stirrups. It was first intended to rest the rails on the edge of the metal plates, but when construction began it was found that the steel trusses were not true enough to serve as rail seats, and that the concrete could be finished to a truer surface than that afforded by the edges of the steel plates. It was therefore decided to finish the concrete about ⅛ in. higher than the steel.

This piece of track has now been in operation 21 months. In that time we have learned a number of things. One of these is that no metal rail seat is necessary, as there has been no wearing away of concrete under the rail, at least not in a measurable amount. Neither has there been any disintegration, even though one rail rests directly on the concrete.

There is very little batter of the usual type, probably less than ordinary track would acquire in the same length of time and under the same traffic. There is, however, more or less of what the street railway men call "cupping," a type of batter that is found on very hard stone-ballasted track, elevated railroads, and rigid tracks in general. This consists of a depression which begins three or four inches from the receiving end of the rail and extends for 10 to 15 in. in the direction of traffic.

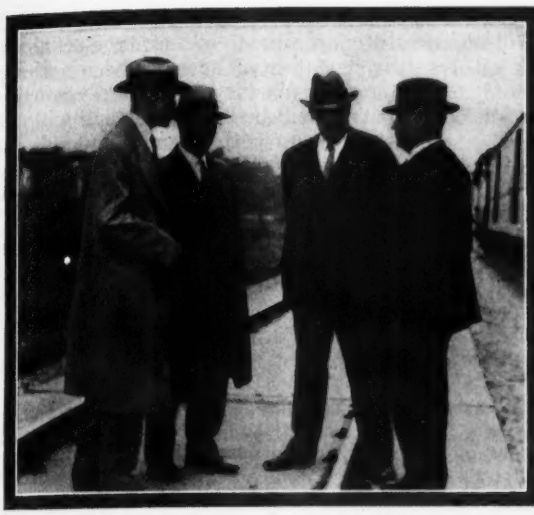
The only anchorage of the rail on the slab is that afforded by the clips that hold it down. This is not enough to prevent creeping. The rails on both the approaches are thoroughly anchored, however, and since this was done, creeping has been reduced to a forward movement caused by traffic and a backward movement due to expansion, with a maximum movement of perhaps two inches.

The north rail rests for its entire length on pressed-wood insulating fibre ⅛ in. thick. This was installed for the purpose of insulation, but the behavior of this rail indicates that some such separation has advantages other than those of insulation. This rail does not seem to move up and down as much under traffic as the other one. Such a layer seems to give a chance for the clips to grip the rail more tightly. It also serves to protect the concrete from any possible abrasion, and perhaps also tends to lessen the noise of passing trains.

The Track Rides Smoothly

The track rides very smoothly, as it has since operation began. In riding over it there is the slight feeling of rigidity that is felt on a viaduct or street railway where the rails have a rigid bearing. There is a sound resembling that heard in passing a freight train, but not so loud, which is due to the reflection of sound caused by the grinding of the wheels and the friction and rattling of equipment. However, the joint clicks, which are the greatest noise-making factor on ordinary track, are not heard; so that, on the whole, the noise is probably not more than on ordinary track.

There has been some settlement, but it has been remarkably uniform. The entire slab has settled an average of about 1½ in. since operation began. About ½ in. of this occurred during the first few



Mr. Chipman Was Questioned by President Davis, President-Elect Clarke and Secretary Donahoe

Mr. Chipman (Third from Right) Explained the Fine Points of the Track Construction

days of operation and in this period practically all the unevenness of settlement also developed. There was a further settlement, which averaged about ½ in. during the following winter months. From April, 1927, to December, 1927, no settlement took place, but levels taken in April of this year show an additional settlement which averaged about ½ in. The difference in the amount of settlement of adjacent slabs is so slight that it cannot be seen with the eye and has no effect on the riding qualities of the track.

No heaving by frost was observed, as the slab rests on top of the old ballast and drainage is good, with an open ditch on one side and a six-inch tile drain on the other. Some measurements were recently made of the amount of settlement under a locomotive. A switch engine weighing 204,000 lb., all on the drivers, was used and the deflection at each joint between sections was observed with a wye level at close range. This deflection was found to be remarkably uniform and averaged .08 inch.

Less Train Resistance

Last July some tests were made to determine the comparative resistance of the track on the concrete roadbed and on the adjacent east bound track. These tests were made by kicking cars over both tracks and measuring the reduction of velocity. From this the resistance on both tracks was computed and it was found that the track on the concrete roadbed had about 0.8 lb. per ton less resistance than the track of ordinary construction. This is equivalent to about 16 per cent of the resistance on level track. This method of determining the resistance was used because the experimental sction is too short to accomplish much by the use of a dynamometer car. The methods were rather crude and it is hoped that the results can be verified later by more thorough and extensive tests.

The only expense yet incurred for maintenance has been due to things which may be entirely avoided by an improved design. A few of the clip bolts have been broken, as only ¾ in. bolts were used, whereas they should have been ⅞ in. or perhaps even 1 in. The breaking of these bolts occurred principally at the ends of the section, where, on account of the change from ordinary track construction, there is more vertical motion of the rail than elsewhere.

We are not giving this piece of track any special care, but are watching it and studying its behavior under ordinary conditions with a view to improving the design. At the beginning of this season, it was the intention to build an additional section, but it was decided to keep the present section under observation for another year before doing so. Many improvements can be made. As a metal rail seat has been found to be unnecessary, the design can be greatly simplified, eliminating structural steel and doing away with the need for special insulation. In the present installation, not much consideration was given to economy of design and more strength was provided than was thought really necessary. Further, a more economical disposition of both concrete and reinforcement is possible. The cost of the short section installed is not much of a guide to what the cost would be with modern facilities for doing the work on a large scale. It is believed, however, that a design can be worked out that can be built for $40,000 or $45,000 per mile, including fastenings, but not including rail.

In addition to developing a design that can be installed at a reasonable cost, it is essential that some method be developed for restoring the roadbed to its original grade in case of unequal settlement. Although settlement of the present section has been slight and very uniform, we cannot hope that this will be true in all locations. In the present installation, pipes were imbedded in the concrete through which dry sand or grout could be forced under the slab with compressed air after the slab had been lifted to proper grade by jacks or crane. There has been no occasion to try this out, nor is there likely to be on the present installation; neither is it probable that this process would be necessary, except at long intervals and over short stretches. However, we believe that something of this kind is essential to the success of a roadbed of this type, and expect to make some experiments along this line.

The matter of a thin cushion between the rails and the concrete is one that deserves careful study, although with a proper design this will not be needed for insulation, and although there is apparently no disintegration or wear of the concrete, even when

in direct contact with the rail; yet, as stated above, the rail seems to behave better if there is a layer of separating material. What material is best and how thick it should be in order to get the best results as to rail wear and batter, creeping and quietness, are all matters for experiment.

So many unknown factors are involved that a satisfactory roadbed of this type must be developed by a process of trial and error. This will take time and it will require still more time to measure the economy that will result from its use. There has been nothing thus far to discourage us in the belief that eventually a roadbed of this type will be evolved, which will not only be satisfactory as to performance, but will result in a saving on heavy traffic roads, that will justify its cost of installation.

The Relation Between the Manufacture and Service of Rails

By C. B. BRONSON

Assistant Inspecting Engineer, New York Central Lines, New York City

THE SECURING of successful service from rails in track, from the standpoints of both safety and utility, depends upon the co-ordinated efforts of three distinct groups of men:—(1), The manufacturer for the production of high quality steel, rolled into rails; (2), railway officers for the design of the section, and specifications governing the acceptability of the material, as well as the formation of the general policy of rail renewal and maintenance; (3), the roadmasters for the installation and maintenance of the rails through the succeeding years.

Volumes have been written on rails almost from the inception of the railways, and discussions have been conducted constantly before technical and maintenance associations. Yet no body of men is more vitally interested, because of their constant and intimate contact with rails, than the roadmasters. Your discussions from time to time have contributed to the advancement and improvement of rail service, and indirectly to their manufacture.

Rail making is a complex manufacturing problem, in which the combined efforts of several hundred men are essential. The present yearly requirement of the railways in the United States is between 2½ and 3 million tons, and individual mills are capable of producing from 1,000 to 3,000 tons per day. This requires a tremendous capital outlay for enormous mills, which are among the finest examples of mechanical, metallurgical and electrical efficiency. A description of the general details of steel and rail making would not seem amiss in a discussion of this character.

Rails Are of Open Hearth Steel

Practically all rail steel in this country is made by the basic open hearth process. The furnaces are long, shallow brick-lined vessels, covered over with arched brick roofs, which serve the purpose of deflecting and controlling the travel of the flames across the hearth. The capacity of the furnaces varies but in general is close to 100 tons. Gas ports are located at either end and furnish the combustion elements for melting. The direction of the flames is reversed about every 20 min., and the waste gases, after passing across the hearth, are led through brick checker-work flues below the furnace floor to conserve energy and for preheating.

A bed charge of limestone and steel scrap is introduced into the furnace through sliding front doors by means of an intricate machine which picks up steel boxes containing the stone and scrap from larry cars directly in front of and in line with the doors. The machine is operated by a series of levers for transverse and lengthwise travel, and the steel shaft which picks up the containers revolves about its axis, depositing the burden on the bed of the furnace. The charging of 40 to 60 tons of material is done quickly, and the gas turned on to start the melting process. As soon as the scrap reaches a pasty condition, a ladle of molten cast iron is poured through one of the front doors, and the refining process starts in earnest.

There are usually 12 to 14 furnaces or units in one battery or "shop" under the charge of two melters, between whom the furnaces are equally divided. At each furnace are stationed a first, second and third helper, and other assistants who are directly responsible for the "working" of the heat, and who report to either of the head melters.

The essential features of the process are the reduction of carbon, together with other impurities, and the creation of a basic slag, by means of the limestone, to eliminate a large percentage of the phosphorus. The progress of the reactions is checked from time to time by taking a small dipper of metal from the furnace and casting it into test blocks, which are chilled rapidly and broken. The long experience of the melters makes them skilled in interpreting furnace reactions by visual examination of the character of the fractures. Peek holes are also located in the furnace doors and, after protecting their eyes with blue glasses, these men observe the condition of the bath, as well as the furnace lining and roof. Occasionally cave-ins or other difficulties arise and constant watching is essential.

"Shaping Up" the Heat

About 8 to 12 hours are required to "shape up" the heat, and reduce the carbon content to approximately 0.15 per cent. In the meantime samples have been sent to the laboratory, where rapid chemical checks are made and reported back to the melter by either phone or telautograph. Representatives of the metallurgical department also keep in close touch with the work, and in case the condition of the bath and its shaping up do not satisfy the melters or the metallurgical department, the heat is diverted into material of far less importance than steel rails.

If the heat is satisfactory, calculations are made of the amount of recarburizer necessary; and the addition is made by using the same type of ladle and spout and in the same manner as the initial charge of molten cast iron.

The removal of the heat, as the furnace charge of metal is termed, is effected by forcing the material out of a tap hole in the back of the furnace with a ram. The molten stream rushes out with a shower of sparks into a brick-lined steel ladle, directly below a runner from the tap hole. The deoxidizers added are ferromanganese and silicon, which have been weighed in

advance, and which are shovelled or run through a chute into the ladle when about one-third full. The furnace is completely drained in from seven to eight minutes, after which a giant electric overhead crane moves the ladle to an adjacent elevated platform for the purpose of casting the steel.

Pouring the Ingot

The bottom of the ladle contains an opening called a nozzle, which is sealed by an insulated circular rod, extending the full height of the ladle. This rod can be raised and lowered by a hand lever, permitting the steel to flow out through the nozzle at the bottom. The molten stream plunges into cast iron molds, set on heavy metal bases, which in turn rest on small buggies for rapid transfer around the plant.

The molds are of various sizes and heights, ranging from 19 in. by 19 in. in section to 25 in. by 30 in. and from 55 in. to 90 in. high. The number of ingots per heat also varies, according to size, from 14 to 50. Considerable skill is required in pouring the ingots, as the molds filled with metal are technically known, so that the steel will set quietly and avoid the tendency toward piping and segregation. The ladle is completely emptied in about 25 to 30 min. unless some unavoidable difficulty arises.

During the pouring process, test ingots are cast, stamped for identification, and sent to the laboratory where representative drillings are taken for chemical analysis. The permissible variation in carbon generally is only 0.15 per cent, with correspondingly close ranges for other specified elements.

The metal on top of the molds freezes over quickly, but the train of ingots remains at the pouring platform for some time after the last mold has been filled so that the interior metal may solidify to some extent. The buggies containing the molds are hauled rapidly to a stripper house, where overhead cranes remove the cast iron shell surrounding the red hot ingot. They are weighed immediately, transferred to the rolling mill building, and placed vertically in soaking pits for the equalization of the surface and interior temperatures, as well as to reach the proper temperature for rolling. This requires a minimum of about two hours, after which they are withdrawn in sequence and start their journey through the rolls.

Rolling the Rail

The ingot is first reduced from its original cross section to a block about eight inches square, called a bloom. The method of accomplishing this varies, some mills using a reversing screw-down mill of many passes, while others have fixed-size openings of various designs which may be either vertical or diagonal. The blooms travel to hydraulic shears where a top discard is made to insure sound metal, and the bottom end is also squared up. Some ingots are so large that three or four blooms may be sheared off, which may make 11 or 12 rail lengths.

The blooms are either reheated or go direct to the rail mill, where they travel through a series of intricate passes until they are gradually reduced and formed into the finished rail shape. The bar, usually two or three rails in length, is sheared by one or more revolving saws and then passes immediately to the stamping wheel where indentations are marked in the rail web, showing the heat number, ingot number and rail letter. The top rail usually bears the letter "A," with succeeding letters for rails lower in the ingot. The rails then move through a set of curving rolls where they are cambered "head-high" in order to equalize the temperature difference and rate of cooling between head and base. Finally they travel to the hot beds where they remain until cold enough to handle. Intricate structural and physical changes occur during this cooling period, which have considerable effect upon the final characteristics of the rails.

The work in the finishing department requires the removal of rail end burrs, straightening in presses with gags (probably the only crude step in the entire process of manufacture), drilling bolt holes, checking rail lengths by suitable tapes, preliminary inspection of the rails and checking of heat numbers, etc., by mill representatives, and finally inspection by railway and steel mill inspectors jointly. The rails are "walked" on top, bottom and sides when the squaring, filing, chipping, drilling, and straightness of line and surface are all observed, and the rails are marked in classifications according to their chemistry and degree of fitness. The classes are indicated by color designations on the rail ends, and the material is separated for use in service according to its known and anticipated physical qualities.

Each step in the process of manufacture is under the constant observation of qualified inspectors and supervisors, and communication between departments, through signals and telephones, makes immediate action possible in case of break-downs or other difficulties. Rail rolling calls for a degree of exactness hardly believable, considering its complicated design from a mill standpoint. Templets made to hair-line accuracy are supplied to the rollers and inspectors, and checks are made on test sections cut from portions of the hot bars. The specification tolerances are close and vigilance is required on the part of everyone directly concerned.

Rail mill officers and representatives, as a body, are progressive and fully aware of the important service required of the product they are manufacturing. They interchange ideas and make progress through committees or individually in the same manner as the road-masters or other bodies assemble to study their common problems, and to progress more effectively. Large sums of money have also been expended in the extension, modernizing and general improvement of the rail mill plants within the past few years, through which the railways have benefitted directly and considerably.

The requirements of the railways are made known to the manufacturer largely through the design of rail section and the specification governing the material, which come within the province of the officers of the roads. While several roads have worked out designs and specifications, based on their own traffic and transportation problems and experience, a large number of the roads follow the standards and specifications developed by the American Railway Engineering Association. This is particularly true within the last few years, with the introduction of heavier rails.

The Trend in Rail Sections

The widespread adoption and installation of heavier section rails is one of the encouraging trends of the present day. Nearly 70 per cent of the rails purchased during the last year weighed 100 lb. per yd. or more, in contrast with only 25 per cent in this classification 10 years ago. Operating and maintenance economies are being realized therefrom while the stability of the track of today, as compared to present locomotives and equipment, far exceeds the mechanical stiffness of the earlier sections with respect to the superimposed loads.

The common error is sometimes noted of comparing rail weights directly with axle, wheel or total loads, which is entirely misleading. The problem is one of

definite engineering principles, and not the bulk weight of one unit against the other. The equation is between the mechanical properties of the rail and the modulus of the track on the one side and the axle loads and their distribution upon the other side. Bending stresses are lowered decidedly with moderate increases in the weight of rail, which condition is brought about by a greater corresponding increase in the mechanical properties of the section.

Most of the present heavier sections are designed with stiffness as a girder as one of the principal and fundamental features. Slab or squatty sections are being looked upon with disfavor. The preferred type has a reasonable amount of metal in the head and flanges, combined with the maximum fishing depth. The carrying capacity of such sections is augmented considerably, while the increase in fishing depth permits the use of angle bars of greater stiffness to reduce the tendency towards drooped and sagging ends, with their attendant churning of the ballast below the joint ties.

A lesser number of sections are being rolled at present than in the early history of the railroads, yet there are still far too many, from the standpoint of the mills. A large amount of money is tied up in rolls and other auxiliary equipment, which is an economic waste. Differences of 1/64 in. in certain dimensions of comparable sections of equal weight require separate sets of rolls, costing several thousand dollars, and without advantage from the standpoint of service.

Requirements in Specifications

Differences also exist in the text of rail specifications, although in general these are more thoretical than practical. Chemical requirements vary, due largely to the type and weight of rail ordered, although slight differences are noted in physical test requirements, the interpretation of the condition of fractured specimens, details of loading, tolerances in weights and dimensions, etc. From a practical standpoint, however, each mill operates on a certain standard basis which has been built up after long experience.

Many specifications contain clauses requiring the nick-and-break test. Specimens from the top ends of three ingots used for drop testing, are nicked and broken. The fractures are examined and if any contain pipes, seams, laps, laminations or other structural deficiencies, all rails in this group are rejected or placed in a separate classification, and other tests made in a similar manner for the rails lower in the ingot. It has been proven by comprehensive tests that the three specimens fractured are not necessarily indicative of the entire heat, when specimens were fractured for every ingot. The requirement places the mills in somwhat of a dilemma in the avoidance of piping and segregation. Several roads have recognized the incorrectness in principle and application of the usual nick-and-break test and have concluded that its cost to the manufacturer and themselves is not justified, based on several years of service tests, and no readily apparent beneficial results in reducing rail failures. A fracture test on every ingot might be useful, but in general it is too costly and slows up the manufacture and shipment of the product.

The necessity for the higher ranges of carbon have been brought about largely because of some compensating increase in hardness to offset the increased head depth and lack of effective penetration of roll pressure. We have obviated this by similarity in design and thickness of head for 105, 115 and 127 lb. Dudley sections. The same chemistry is specified for all three weights of rails; the carbon being lower than some specifications require, and less conducive to brittleness and possibility of rail failures.

Another departure in practice is the discarding of the "A" rail at the shears for hot-worked tie plates. Theoretically, this removes a considerable portion of the potential rail head failures, but their elimination is not complete as similar failures occur in other portions of the ingot. A further disadvantage of this arrangement is that the hot-worked tie plate specification is ordinarily broad enough to permit the use of discard steels over a wide range in carbon outside that for rails. While this may be advantageous in manufacture, several roads have preferred to use 0.20 to 0.30 carbon steel with approximately 0.25 per cent copper. Experience shows that this material corrodes at about one-half the rate of high carbon hot-worked plates, and has ample strength to distribute the loads properly to the ties, when correctly designed.

The "A" rails are rolled from that portion of the ingot more susceptible to segregation and inclusions, but the practice of placing these rails in a separate classification and restricting their service to tangents or slow speed light traffic results in materially improved conditions. Until three or four years ago the common practice was to mix "A" rails with other classes of varying carbon content, many of which found their way into the low side of curves and accounted for numerous failures of the head type, which can be avoided under the present system of separation at the mills and restriction in service.

Many experiments have been instituted with the express idea of improving the physical and structural qualities of rail steel. Some have originated from the efforts of the manufacturers, while others have had their origin in the joint action of the steel companies and the roads. In most cases the experiments have been terminated or abandoned because of higher cost, or no appreciable improvement in service, while in some instances failures of certain types have increased.

Various types of molds, deoxidizers, alloys and chemical compositions, as well as heat treatments, have been resorted to but largely abandoned. However, there are at present two promising developments which are commanding attention:—(1), The commercial production of heat-treated rails, instead of being done on a restricted experimental scale, is apparently moving forward towards this goal; (2), the more widespread introduction of intermediate or medium manganese rails.

Several installations of heat-treated rails have been made and are now under observation on lines of heavy traffic. Promising results have been indicated to date, and this fact, coupled with the increase in physical properties and refinement of grain structure, makes the future possibilities of this material stand out conspicuously. The processes for treatment are, in general, simple, but demand close supervision and accurate temperature control if consistent results are to be secured. This development has come about largely through the efforts of certain manufacturers, and, until more fully established and supported by more comprehensive service test results, little can be said.

Medium Manganese Rails

The second prominent development is the further extended use of intermediate or medium manganese rails. While this is a new departure in open hearth rail steel, it was used extensively in the nineties in the Bessemer process. Remarkable wear and service records eventually led one progressive officr of an eastern road to experiment with similar composition made by the basic open hearth furnaces. Large tonnages have

been installed by several roads during the past three or four years, including approximately 85,000 tons on the New York Central Lines. The advantages of this steel, based on our experience and that of others, may be summarized as follows:

(1) The quiet setting of the steel in the molds indicates more complete deoxidization.
(2) An advantage in rolling, from the free flowing action of the steel.
(3) A lower percentage of seconds, amounting to 50 per cent at certain mills.
(4) A noticeably finer grain structure, both in the fracture of specimens and under the microscope.
(5) Cleaner steel, with decidedly less segregation in the "A" rail, based on tests of entire heats adjacent to the top rail of every ingot for both medium manganese and standard open hearth steel.
(6) Increased toughness and shock resistance on full sections of rails.
(7) An elastic limit nearly 25 per cent higher, with correspondingly increased ultimate strength over similar physical properties of standard open hearth steel.
(8) An inreased endurance limit, according to present information.
(9) Less batter and chipping at rail ends, and reduction in transverse flow of head surface metal.
(10) A lower rate of wear, particularly on the high rail, indicated by comparative tests.
(11) Rail failures reduced, especially interior transverse fissures for certain mills.

Little change is necessary from standard open hearth practice, necessitating a reduction in the amount of liquid recarburizer added just previous to tapping the heat, and increasing the amount of ferro-manganese in the furnace and ladle to make the necessary compensation in adjusting to the new composition. In general, no special mixtures or methods of working the heat are required beyond those essential for the production of standard basic open hearth steel. The only drawback so far noted is the slight increase in the percentage of rails rejected on account of piping, but this does not appear to be serious. As the advantages of this grade of steel become more obvious by service trials, its use will undoubtedly be more widespread.

Rail manufacture proceeds so rapidly, from the making of the steel, through the rolling, finishing and shipping, that the material is in the hands of the mill representatives only two or three days at the most. Roadmasters and maintenance of way men, however, have the handling of the rails for installation and subsequent maintenance over a continuous period of 10, and possibly 20 or more years. Their problems are diminished in proportion to the skill with which the rails have been manufactured. Conversely, the maximum value of the rails is attained through the care with which they are installed and maintained.

Protection of Rails in Track

The method of installation is of decided importance. New rails have a degree of surface softness from the setting of the steel in the molds, and the action of the soaking pit gases causing surface decarburization. The metal is susceptible to flow, particularly ahead of the time when the cold rolling action of the wheels densifies and hardens this surface. It is essential that the expansion allowance between rail ends be adjusted correctly, and it is decidedly important that the surfacing and spacing of ties follow immediately, if possible, after the installation of the rails, or with a minimum of delay, to avoid battering and flow at the rail ends, the development of chipping, and the spotty and erratic side flow of the rail heads, which is frequently noted. Many of the difficulties encountered with bad ends or joints are due in large measure to neglect of new material after installation. So far as the head surface metal is concerned, it needs more attention during the period following installation than after cold rolling has developed on the bearing surface.

If end flow develops between the opposite adjoining rails, and indications of chipping are apparent, it is advisable to either chisel or preferably grind out the thin layer of overhanging metal. It is frequently the case that deeper and larger shelled-out spots occur which could easily have been avoided. More rails are renewed yearly and have their service shortened by reason of battered and chipped ends than from any other cause, thus constituting this as one of the major problems in maintenance work on rails.

Wear of rail heads on tangent tracks is a minor factor in renewals, compared with the major problem of difficulties with rail ends. The loss in head depth on tangent track under heavy traffic averages close to 3/32 in. in 10 years, and the rail would still have many years of service, if it were not for the condition of the rail ends.

Curve wear is virtually a separate problem and is met in a number of ways. The simplest is the installation of blue end or higher carbon rails within the range specified, which add somewhat to resistance to abrasion. Medium manganese rails are proving advantageous for the same purpose. The most successful material is 10 per cent to 15 per cent water-quenched manganese steel, but the cost is too high for general installation. This material is free from the general types of failures, but has one deterring feature in that it acquires permanent sets due to its low elastic limit and lack of resilience, and is useful practically only in slow speed service. Nearly all recent test installations of heat-treated carbon rails have been on sharp curves, where the reports indicate a considerable increase in life compared to the same material untreated.

Rail Failures

Another important phase of rail maintenance with which the roadmasters are concerned is that of rail failures. The extent of this problem varies, depending upon traffic conditions and the plant from which the rails were purchased. The rate of failure, particularly of certain types, varies considerably between mills.

The base, half moon, and web failures, which were numerous in Bessemer rails, have so diminished in open hearth steel as to be of minor importance. Investigation of numerous broken rails has shown that a majority had their origin at seams in the base. Other broken rails are due to slippage or burned spots on the bearing surface, and develop downward through the section.

Failures in the web at the bolt holes are associated almost entirely with joint maintenance conditions. Cracks develop at the edge of bolt holes under constant pounding on the rail ends and progressive fractures result. This failure is prevalent for suspended joints with short angle bars. Experience extending over a quarter of a century with the three-tie joint and long angle bar has demonstrated that such failures are a small fraction of one per cent for all weights of rail from 80 lb. to 127 lb. per yd.

Head failures are of two general types, crushed and split. Both have a common origin in the weakness of segregated or unsound steel, and are more prevalent in "A" than in lower rails of the ingot. The crushed head is a local flattening and distortion laterally of the head metal and is troublesome but not serious. Confusion still exists in differentiating between split heads and piped rails. Several roads report piped rails as their principal problems, when such failures are of rare occurence. The difficulty lies in the apparent similarity of the

two defects. Pipes are located in the web and partly in the lower portion of the head. Split heads have their origin just beneath the bearing surface, and travel downward, causing a widening of the head, and a hollowing out of the bearing surface, and leaving a dark streak on top; in advanced stages they appear as cracks in the fillet underneath the head. Advance information of impending failure is thus indicated and such rails can be removed long before complete rupture develops.

Interior Transverse Fissures

Interior transverse fissures are head failure developments of a more troublesome nature because they give practically no indication of their presence in the interior of the head. Discussion of this defect has continued for the last 17 years, and large sums of money have been expended in research and investigation into the origin and cause. The conclusions are far from being unanimous, except that the interior metal is brittle, low in physical qualities, and has been injured by some force which creates the nucleus or origin. The shiny surrounding surfaces are universally recognized as a development in service from the wave motion and reverse bending under traffic. The debatable point is the reason for rupture of the nucleus. Mill conditions undoubtedly have an influence, for rails on heavy freight and passenger lines, manufactured at certain mills, are largely immune, while failures occur on lighter traffic lines in rails from other plants.

Fissures remained undetected in the rail until fracture occurred, until E. A. Sperry recently developed the detector which bears his name and which has solved the problem. The size and location of even the smallest fissure are now known with a degree of exactness which seemed unbelievable at first. Actual road tests are under way and within a brief period equipment will be available for more general use. The development of this detector car is the most outstanding and far-reaching measure of progress in rail service within recent times, and will prove invaluable for this specific purpose. At the same time, a series of studies are being made for the utilization of this principle for the location of internal defects in rail heads immediately following their manufacture. Such research work consumes time, and patience is, therefore, essential in the desire to attain immediate results.

Rapid advancement and improvement in rail and maintenance work have occurred within the last few years. In addition to the features which have already been pointed out, there has been a noticeable improvement in the physical character of the roadbed, as is apparent by riding over the various lines. This includes better ditching and drainage, an increased depth of ballast of more stable materials, ties of increased cross-section and length, bored and adzed as well as treated, heavier tie plates to protect ties and decrease bearing pressure, improvements in angle bar design and treatment, along with heat-treated bolts, mechanical equipment for the rapid handling of materials and their maintenance, and, most of all, the spirit and cooperation or the men on the "firing line" and those responsible for the supervision of the work. No one is so idealistic as to consider that the millennium has been reached, for many problems are still ahead; yet we feel encouraged at the advancements that have been made, and are aiding in the increased efficiency of transportation.

The Conservation of Revenue Earning Equipment in the Handling of Maintenance of Way Material

REPORT OF COMMITTEE

ONE OF THE serious burdens imposed by the rolling equipment on railroads is the transportation for distribution of the materials used in the maintenance of the roadway and structures. An idea of the size of this task can be formed by considering the distribution of the single item of crossties on a railroad of 10,000 track miles. Speaking for the average railroad we will not be far wrong in saying it requires two-thirds of a carload of ties per year for the maintenance of each mile of track. A 10,000-mile road would, therefore, use about 6,667 carloads of ties per year. At an average of six days for a round trip from loading point to the place of release and return to the loading point for each car in the distribution service we develop the figure of 40,000 car days for the annual crosstie distribution work on one of our larger railroads. The same railroad will use probably 15,000 carloads of first class ballast per year and must dispose of 15,000 or more carloads of cinders and refuse yearly. Much of this work must be done by cars which would otherwise be in revenue service, earning from $5 to $10 per day.

To its paying patrons a railroad allows only two days free time after placement for the loading or unloading of cars, after which car detention charges are assessed. In times of car shortage much propaganda is put out and much missionary work is done by the railroads in an effort to get shippers to utilize or release equipment in less than the legal time allowance.

It is, therefore, incumbent on a railroad, not only as a matter of consistency, but in order to conserve its equipment for its revenue-yielding service, to speed up as far as is possible and economical the movement of equipment engaged in its material-handling work. It is the purpose of this report to discuss and suggest ways of accomplishing this.

Bulk of Material Moves in Carload Lots

The main bulk of track maintenance material moves in solid carload lots and each car should be billed direct to the supervisory officer directly responsible for the distribution and use of the material. To save delays at junction points or in yards awaiting reconsignment it should be billed direct to the station at which it is to be unloaded or from which it is to be distributed. The agent at the receiving station, upon receipt of a car of company material, should immediately wire the consignee to whom the car is billed, giving the car number, initials and contents.

Where possible (and it is usually possible), a maintenance supervising officer should place unloading instructions for each carload of material in the hands of his unloading foreman, before the car arrives. On receipt of the arrival advice, he can follow up by wire the carrying out of these instructions or issue instructions where this has not already been done.

The time-honored practice of having cars of material billed from the manufacturer to a general officer of the railroad at a junction point or yard for reconsign-

ment, and the passing down of unloading instructions through various officers, by letter or message after the car has arrived at destination, is productive of great unnecessary delay and should be avoided. By a little more thought and pains in the office which places the order, final destination billing instructions can be sent to the originating point of practically every carload of material, unnecessary delays in transit saved and the starting of unloading expedited.

Use Cars Not in Active Demand

Another economy can be effected by selecting, for company material loading, classes of cars not in active demand for revenue service at the time the shipment is made. For instance, most railroads own a considerable number of stock cars. The demand for these cars in revenue service is ordinarily limited to a short season each year and during the balance of the time the cars are a drug on the equipment market. Yet stock cars are well suited to the handling of crossties and lumber, which can be handled to a large extent in other than the live-stock movement season.

Some railroads have effected economies by fitting up and assigning to company material service, cars which are no longer fit or suited for revenue service. One line, for instance, met its cinder and refuse handling requirements by withdrawing from its coal-handling service and assigning to cinder and refuse service, about 800 old composite wood and steel hopper cars which had about outlived their usefulness in heavy-train, tonnage coal service, but which were still good for many years use in local-freight and work-train service. These cars had a depreciated book value of about $250 each, but they handle engine cinders equally as well as new steel hopper cars carried at a book value of $2,000. Thus, there is a difference in capital carrying charge of $105 per year per car, a worth-while saving. The sight of a new steel car with its sides warped and the paint blistered by loading with hot engine cinders is a reminder that less expensive equipment might be used with greater economy in that service.

In the same manner, old steel-underframe gondolas or box cars can be cut down at small expense and converted into very satisfactory maintenance-of-way or work-train service flats, a certain number of which are a necessity on every road. Most lines have a considerable number of side-dump cars for construction or grade revision work. When not engaged in this work they can be used to good advantage for cinder and refuse handling, particularly when the material is to be used for bank widening.

Deliveries in Carload Lots

As far as practicable, supplies should be purchased or handled in carload lots, as the cost per ton for handling and the number of cars required for the total service is less than when the supplies are moved more frequently in smaller lots. In the movement of the major track materials—rails, ties and ballast—frequent checks should be made to see that cars are being loaded to their maximum weight or cubical capacity. In many cases we have educated our shipping patrons considerably more than our own employees in this respect.

In the actual handling of cars for the unloading and distribution of the material where it is to be used, interesting problems present themselves. Where the material is to be scattered along the track and only one or a very few cars are to be handled, it can often be done without delay or excess cost by the local freight, the cost of which, per hour of service, is very nearly the same as a work train. Where rails or many cars of other supplies are to be unloaded, work-train service is usually more satisfactory and economical. When the distribution is to be made within a limited distance from a siding, it is often more economical to unload at the siding and distribute with push cars or motor cars and trailers. When there is little difference in the labor cost, the method should be selected which will effect the most prompt release of the car.

While we have been referring to the unloading of cars, it must be kept in mind that it is just as important, from the standpoint of car conservation, to load and move a car promptly after placement as to unload it without delay at destination. Intelligent loading can do much to reduce the number of cars necessary for any service. Small-lot shipments from central supply points should be made in trap material cars to be unloaded as the car progresses, or, if there is not sufficient material to justify a car, they should be made as ordinary l.c.l. shipments. The general use of regular supply cars for handling small tools, oils, stationery and similar supplies is for the purpose of expediting and reducing the cost of distributing this class of small-lot supplies.

Greater Use of Motor Cars

With the improvement and more general use of motor cars, a considerable reduction in the cost of distributing crossties and other material has been effected, particularly on lighter-traffic and branch lines, by the extended use of motor cars with trailers for assembling material at sidings or distribution points or for distribution from sidings. A work train or a local freight at a cost of from $10 to $15 per hour of service is expensive.

Stress should be laid on the importance of specifying the kind of car wanted on an order. A shipper of 40-ft. piling, for instance, would not order simply a gondola or a flat car and take a chance on getting one of the right length. Yet cases have been noted where flat cars were ordered, assembled and equipped with side stakes for loading rail and then it was found that the rail was all in 39-ft. lengths and some of the cars were of the 36-ft. class.

The average maintenance-of-way supervisory officer has been trained to look with horror upon an idle man in his forces. If he will get clearly in his head the fact that a railroad's freight cars bring in the greater portion of all its earnings, and will learn to look upon an idle or unproductively-employed car with the same disfavor that he regards an idle or wastefully employed man, it will be the equivalent of adding many expensive cars to his road's equipment.

Committee: R. H. Smith, chairman, superintendent, N. & W., Roanoke, Va.; W. O. Frame, engineer maintenance of way, C., B. & Q., Burlington, Iowa; C. W. Baldridge, assistant engineer, A., T. & S. F., Chicago; E. Galvin, supervisor, Penna., Niles, Ohio; W. D. Bagby, roadmaster, St. L. S. W., Malden, Mo.; G. G. Smart, general roadmaster, G. N., St. Paul, Minn.; H. H. Wise, supervisor, C., C., C. & St. L., Anderson, Ind.; and G. P. Asbury, engineer maintenance of way, Southern, Danville, Va.

Discussion

P. J. McAndrews (C.&N.W.) stated that he had found economy in the use of old cars, such as flats, that were no longer of value for revenue service, for distributing small quantities of rails and other track materials, although, since there are limitations on the use of such cars in regular train service they cannot be employed for the transportation of large quantities of material. His remarks led to an extended discussion of the character of equipment employed in hauling ties. A. M. Clough (N.Y.C.) and a number of others objected to the use of stock cars,

owing to the greater amount of labor and the longer time required to unload ties from them. James Sweeney (C.&E.I.) contended that high-side gondolas were just as hard to unload, while J. B. Kelly (M.St. P.&S.S.M.), W. O. Frame (C.B.&Q.) and other speakers supported the committee's recommendation that stock cars be used where the movement of ties is opposite to the normal direction of stock shipments.

Methods of Preventing and Overcoming Damage to Rail Ends

REPORT OF COMMITTEE

THERE IS an old saying among trackmen that "the life of the joint is the life of the rail." This would seem to be a very true saying as it is probable that more rails are removed from the track as a result of rail battering and other troubles at the joint than from abrasion on curves. In reporting on Methods of Preventing and Overcoming Damage to Rail Ends, we find that the problem resolves itself almost entirely into a consideration of joint maintenance.

Engineers and trackmen have often raised the question why, with equal maintenance and traffic conditions and identical rail sections, some rail ends are damaged very little or not at all, while others are battered rapidly? It seems almost impossible to find a section of track where conditions are equal at all times. A roadbed of soft material makes it almost impossible to keep joints properly supported, and if this is not done, wear soon starts in the joints. One or two loose bolts may contribute greatly to the development of batter, regardless of other conditions. It is also probable that soft spots in the rail at the ends cause unexplainable batter.

Precautions When Laying Rail

In order to prevent damage to rail ends, it is essential that the rails should be laid properly when new tracks are constructed, or when relaying is done on old tracks. In distributing rail, care should be exercised to group rails of the same carbon content together, especially on double track railroads, where the receiving rail may be battered. Proper allowance must be made for expansion when laying rail, this to be determined by the use of a thermometer applied on the rails at the time they are being installed.

Rail ends should be cleaned off with a broom or brush within the limits of the joint bars and a heavy oil applied where they engage the rail. Joint bars should be full bolted and bolts well tightened before trains are allowed to pass over them. As the bolts are tightened, a maul should be used to drive the joints up to a tight fit on the rail. In using the maul, the joint should be struck on the edge of the flange and not on the top of the web. Nuts should be tightened the next day after rail is laid, and thoroughly retightened ten days later.

In laying rails, they should not be driven back hard and shims should not be removed until the joints are full bolted, and 12 rails have been laid ahead. Then shims must be removed, so that the expansion will continue to be properly distributed. To secure perfect adjustment, no spiking should be done until after the joints are full bolted and no spikes should be set at the end of the bars, or in slots, where they will interfere with the free movement of the rail.

Rail anchors in sufficient number should be applied as the rail is laid, and both rails must be anchored to the same tie, to prevent the ties from slewing. It is important that joint ties should be brought up tight to the bottom of the rail by tamping, or if the ballast is frozen, shimming should be resorted to. The track should be surfaced, lined and ballasted, and joint ties spaced as soon as possible after rail is laid.

With rails properly laid, their life in the track depends upon the attention given in maintenance, especially at the joints. All main track joints should be inspected every day; and cracked or broken bars and bolts replaced. Any unusual trouble with nuts, bolts, locks, etc., should be promptly reported by foremen. Ties must be kept tamped up tight to the rail, and the cribs kept filled in with good clean ballast. The proper amount of ballast must be maintained at the ends of the ties to protect the roadbed at the joints, so the ties will not work loose. Good drainage is especially important.

The prevention of rail creeping and the maintenance of the proper expansion allowance cannot be emphasized too highly. Any indication of creeping should be reported immediately and steps taken to secure additional rail anchors.

Rail battering can be minimized by keeping track joints tight enough to develop the strength of the joint but not too tight to prevent the uniform distribution of expansion and contraction. Good maintenance with respect to ties also helps.

The percentage of rails damaged by end flow and subsequent chipping is very high. This is due to rails being too tight together, resulting in the flow of metal from one rail to another. When the rails contract on account of cooler weather, this sheet of metal is ordinarily forced out, leaving chips in the ends of one or both rails. When this condition is general over a long stretch of track, it is probable that the proper expansion was not allowed when the rails were laid, or insufficient rail anchors were applied, which deficiencies permitted the closing of the expansion gaps between rail ends.

It is the practice on some railroads to require their section men to watch for end flow and where it is noted, to cut it off during the winter months, or while the joints are open the widest. To prevent chipping, a number of roads have resorted to bevelling the ends of rails ⅛ in. back from the end and to a depth of ½ in. below the top.

The re-conditioning of rails by building up battered ends by gas or electric welding is practiced on nearly all railroads, and is increasing. The expense of doing this work depends upon the condition of the rail. The practice is more economical when the work is done before the dip in the rail at the joint is too great. It is more economical than re-sawing as it eliminates loss due to cut-offs and transportation charges and decreases the number of joints in the track.

Rail may be reclaimed by re-rolling and re-sawing at a permanent mill or by a portable saw. Where rail is to be relaid at the same location it has been found more desirable to use portable saws to saw the rail adjacent to the track, thereby eliminating transportation charges. The expense of re-sawing in this manner is not much higher than when sawing is done at a mill,

while a better job of relaying can be done as a better fit can be secured at the joint than where rail is sawed at the mill and relaid indiscriminately in the track.

In many cases, batter is materially retarded or prevented by the application of re-formed angle bars or tapered rail joint shims. Inquiry among a number of railroads shows that they favor this practice; it is especially desirable before building up joints by gas or electric welding.

Committee: C. F. Allen, chairman, division engineer, C. M. St. P. & P., Milwaukee, Wis.; W. H. Jones, roadmaster, A. T. & S. F., Chillicothe, Ill.; W. E. Davin, roadmaster, P. & L. E., Pittsburgh, Pa.; W. P. Wiltsee, chief engineer, N. & W., Roanoke, Va.; D. K. Newmyer, roadmaster, S. P. Lines, Houston, Tex.; J. J. Gallagher, roadmaster, M.-K.-T. Mokane, Mo.; and J. A. Roland, roadmaster, C. & N. W., Missouri Valley, Iowa.

Discussion

W. D. Frame (C.B.&Q.) objected to the recommendation of the committee that shims be removed 12 rails behind the point where rails are being laid, because he felt that this would not insure against the expansion being driven back. He stated that it was his practice to leave them in until the close of the day's work. M. Donahoe (C.&A.) pointed out that this could not be done if traffic were permitted over the track during the day and the shims were of a type that project above the top of rail. Furthermore, as pointed out by J. B. Kelly (M.St.P.&S. S.M.), this practice results in excessive expansion allowance as the temperature of the rail increases during the day. L. Coffel (C.&E.I.) thought that from 12 to 20 rails is ample distance, while G. H. Strople (B.&O.) felt that the rule should be so worded as to permit the removal of the shims as soon as all bolts had been tightened. This view was endorsed by T. Thompson (A.T.&S.F.).

A reference by W. H. Sparks (C.&O.) to the serious problem of chipped rail ends started a lively discussion of that subject, a number of speakers relating their experiences. C. W. Baldridge (A.T.&S.F.) stated that the chipping of rail ends is found only at joints where the two rails are in contact or where there is evidence that they had been in contact at some time previously. He said that chipping was intensified when the condition of "tight rail" is experienced frequently, due to an unequal distribution of the expansion. He cautioned against an excessive tightening of bolts as having the effect of "freezing" the joints, with the result that the expansion cannot be distributed. He also endorsed Mr. Kelly's opinion regarding the necessity for the removal of expansion shims promptly in order to insure accurate expansion allowance. William Shea (C.M.St.P.&P.) expressed the opinion that poor workmanship in sawing rails at the mills, particularly the failure to remove fins, has an influence on the current prevalence of chipping.

The committee's endorsement of the practice of building up battered ends of rails by welding received the approval of a number of speakers who reported favorable results. D. E. Callahan (Penna.) and H. R. Clarke (C.B.&Q.) made specific reference to mileages of track on which welding had given excellent results.

The Essentials of High Speed Track

By J. F. DEIMLING

Chief Engineer, Michigan Central

THE MICHIGAN CENTRAL has had a long career, measured in years. It is almost one hundred years old, which covers a most eventful cycle in transportation. In fact, its beginning was the commencement of rail transportation in the then western wilderness and was antedated by only a few years by the first railroads in the United States, which had been started on the Atlantic seaboard.

Our first line was incorporated in June, 1832, as the Detroit and St. Joseph railroad; it was sold to the State of Michigan in 1837, and its name changed to the Central Railroad of Michigan. It was built in short pieces, evidently as fast as money could be borrowed over a period of several discouraging years, reaching Kalamazoo in 1846. Many amusing and tragic records present strong evidence of the difficulties encountered in raising the money by bonds which were afterward largely repudiated by the state.

In 1846, the state was bankrupt, and the people put the road on the bargain counter as they were sick and disgusted with trying to operate railroads. It was sold to two young Eastern men—James F. Joy and John W. Brooks, who had come West to grow up with the country.

These gentlemen paid $2,000,000 for the 145 miles of so-called railroad, which included $68,000 worth of rolling stock, the largest item of which was a locomotive weighing 12 tons. Four passenger and freight stations existed, one of which, in Detroit, was located about where the city hall now stands.

The Michigan Central railroad was the name chosen for the new company, who took possession in September, 1846. The charter was drawn by Daniel Webster and was put through the legislature only after much debate and objection. One amendment that was offered required that trains should not be run on Sunday; another, that the directors should be required to attend church twice on Sunday. The track was of the strap rail type 2¼ in. wide by ½ in. thick, fastened to longitudinal timbers 6 in. square, laid over mudsills resting on the roadbed.

Marked Change in Track Standards

You will see from this that it is a long step upward to the track of today with 127-lb. rail 7 in. high and with a base 6¼ in. wide, laid on 7-in. by 9-in. creosoted ties, 8½ ft. long and resting on 12 in. of stone ballast and an excellent bed of sub-ballast.

The yearly payrolls of the track department alone are now 1½ times the total amount paid for the road in 1846, being $3,275,000, and the yearly expense of all maintenance of way is $10,000,000, or five times the purchase price in 1846. This 82 years is a long time, and yet one of our roadmasters, who passed on only a few weeks ago at the age of 90 years, saw much of this transformation, as he spent most of his life working on the track. One of his often repeated stories was that, up to some certain date, he had lifted the track over a certain sink hole, 89 ft. 6½ in.

The Essentials of Good Track

The first necessity of a good railroad is drainage; it cannot be good without drainage. Water is the most unstable of the elements and causes much grief

The Inspection Party Examined All Details of the Pere Marquette's Test Track Carefully

to trackmen. Money spent to get perfect drainage yields large returns. We are and have been spending much labor and material for adequate drainage and gradually we have drained practically all our cuts with tile of various kinds; also in the summer we keep the ditchers continually at work, ditching the cuts and widening the banks to maintain an adequate foundation for the ballast. These things are of first importance in getting a smooth riding track.

On our Canadian division, where we have a heavy clay soil to contend with, we find the so-called "French drain" of great help. It is a narrow trench excavated in the embankment at right angles to the track from the toe of the slope up to the rail and filled with small stone and cinders or tile. These drains are put about twenty or thirty feet apart. At track pans, drainage is especially necessary and difficult at such points, and we use longitudinal tile drains between tracks for the entire length of the pan, with frequent cross drains of corrugated perforated steel pipe connected with catch basins.

In the September issue of *Railway Engineering and Maintenance* you will find an able article on this subject, written by the chief engineer of an Eastern railroad that is known for well maintained track and progressive maintenance methods. You will be well repaid by a careful study of this article as it emphasizes exactly what I am placing as a first requisite of good riding track.

All bridge decks have ballast floors with regular track ties, enabling the trackmen to surface the track as at any other place. These measures are not new, but they are refinements that help very much in preserving line and surface of good riding track.

Use High-Grade Ballast

We have a minimum of 12 in. of ¾ in. to 2¼ in. stone ballast, the contour of which is 4 in. below the top of tie at the ends and slopes to a neat line 5 ft. beyond the rail. We require the trackmen to keep this line true and furnish them with templets so that they can maintain it uniform. Neatness is of vastly more importance than merely appearance. It has the effect of drilling men in being neat in all other kinds of work. The actual cost is comparatively small, but it pays a large return in the way of discipline and training.

Our ties are largely red oak, creosoted at our Toledo plant, which is operated under contract with the Federal Creosoting Company. The ties have a 9-in. face, are 7 in. thick and 8 ft. 6 in. long and adzed and bored at the plant. This insures a level surface for the tie plate and is of much benefit in giving a full bearing for the plate and the rail, and eliminates adzing which is so destructive.

The treating process generally is under the supervision of Dr. Hermann von Schrenk, who has charge of this work for all the New York Central Lines. In the last issue of *Railway Engineering and Maintenance*, there appears an article by him on the causes of mechanical deterioration of ties—which I commend to your careful consideration as it contains much valuable information. We have installed a section of test track near Ann Arbor, in which we have used tie plates 12 13/16 in. by 7½ in., secured to the tie with screw spikes and with wood shims 5/16 in. thick, of the same size as the plate, inserted between it and the tie. The purpose of this, as fully explained in the paper above mentioned, is to prevent the mechanical wear of the tie and prolong its life.

Our ties are all plated with wrought iron shoulder plates, 7 in. wide by 11 in. long, with a minimum thickness of ⅜ in., inclined 1 in 44 and 1 in 20, with a so-called waffle iron bottom, the ribs being 5/32 in. deep; these plates weigh 13.4 lb.

Heavy Loads Require Heavy Rails

The New York Central Lines use the Dudley section rail developed by the late Dr. Dudley. The 127-lb. section is our standard for main line use. It illustrates the great advance in sustaining the 63,000 to 67,000 lb. axle loads of the locomotive now in use, as well as the 80 to 90 ton passenger cars and freight equipment with more than 70 tons load.

The design of the joint has kept pace with the rail. Our angle bars are 38 in. long, with 6 bolts ⅞ in. in diameter, with Harvey Grip threads. In highway crossings and station platforms, we have derived much benefit from welding the rail ends with the acetylene torch, making a continuous rail through the crossing, the angle bars being applied in the usual way.

We have built up several difficult street crossings about 100 ft. wide in this way, that have not required any attention for over a year. About 50 trains pass over them in each direction daily, many at high speed. In the wide crossings, we have used rails 60 ft. long to reduce the number of joints. In one of these crossings, the welded rails carried the traffic safely for 12 hours during construction without the angle bars being applied, owing to a misunderstanding on the part of the track foreman in charge.

For many years, we have made our rail and ballast renewals by contract, with entirely satisfactory results. The contractor works under a detailed specification and furnishes the entire organization, including

superintendent, foremen, laborers, tools and camp equipment, the railroad delivering the material at the exact place required. An experienced track foreman is with each gang all the time as an inspector, and also to see that the flagging is properly done, as well as attending to the safety of the track. All the work is done without delay to traffic, other than a slow order of 30 m.p.h. A greater quantity of work per day by this method is accomplished for the reason that the program is not interrupted, as is often the case where company extra gangs are used, and the number of men employed is uniform and regular, Also, the regular track gangs are not taken off their routine maintenance work. The contract work is paid for on a unit-price basis. I am sure that this method is the most satisfactory one for making large rail and ballast renewals, and is more economical than the usual one; we have used it for about 20 years.

Generally, the cost of maintenance is divided, 44 per cent for material and 56 per cent for labor and the proper application of the two gives one result—good track. Good material can always be purchased, but good labor is not so easily delivered. Men must be recruited, trained and led with great patience and firmness. This is called supervision and is the task laid out for you and me. The amount of skill, common sense and general intelligence that is put into the supervision largely determines the result. To me one thing is certain. Ordinary brute force will not do it, but marvelous results are attained by cooperation between the laborers and the foremen and between the foremen and the roadmaster.

The greatest force in the world is the will to serve. When it is born of enthusiasm, it is dynamic in its intensity. When it emanates from a sense of duty, it endures.

In our own case, we are fortunate in having an organization that has a long service record. A section foreman was retired a short time ago who had been for 50 years on a main line section of track, carrying very heavy traffic, and he was as alert mentally and physically on the day of retirement as he was when many years younger. Such men are the firm foundation of good track. Our 32 roadmasters have an average service of 31 years and our assistant roadmasters, 26 years. Over one hundred of our foremen have over 20 years service. Our foremen are required to work with and lead the men; we regard this as an important practice.

Samuel O. Dunn Speaks at Annual Dinner

APPROXIMATELY 500 members of the Roadmasters' and the Track Supply associations and their guests were present at the annual dinner of these two associations in the Book-Cadillac hotel on Wednesday evening. Frank E. McAllister, president and general manager of the Kalamazoo Railway Supply Company, Kalamazoo, Mich., and vice-president of the Track Supply Association, acted as toastmaster, and after brief introductory remarks, introduced the various speakers. The principal speaker was Samuel O. Dunn, editor of the *Railway Age*, whose address was followed by brief remarks by J. B. Strong, president of the Ramapo-Ajax Corporation, New York; C. R. Harding, engineer of standards, Southern Pacific, San Francisco, Cal.; and John V. Neubert, chief engineer maintenance of way, New York Central, New York. Mr. Dunn's address is presented in part below:

Public Is Inconsistent

"The inconsistent attitude of the public, business men and regulating authorities regarding transportation matters presents to railway managers a dilemma so serious as to create a national problem of the first magnitude. The public constantly demands more reliable, speedy, safe and even luxurious railway service, and at the same time constantly supports government policies which make it more and more difficult for the railways to render the kind of service demanded.

"No better illustration of this could be given than is afforded by developments that have occurred within recent years and are still occurring. When the railways were returned to private operation in 1920, their properties were in an unsatisfactory condition and their service was inadequate and unreliable. There was a strong public demand for a great improvement. The tracks and other permanent structures of the railways represent the bulk of the investment in them, and unless they are adequate and in good condition, it is comparatively futile to try to render good service by improving locomotives and cars or adding to the number of them.

"In carrying out their program of rehabilitating the properties and improving their service, railway managers have, therefore, devoted great efforts and expenditures to the betterment of roadway, tracks, signaling and other permanent property. The new investment made in these permanent facilities within the last six years, exclusive of that made in locomotives and cars, has been about $2,500,000,000. In addition, the annual expenditures made for the maintenance of these permanent structures have been increased from about $422,000,000 in 1916 to about $865,000,000, or considerably more than 100 per cent. The improvements have been greater on some railways than on others, but they have been made on railways throughout the country and have been of every conceivable kind. Rail in main-line tracks weighing 85 to 90 lb. per yd. has been largely replaced with rail weighing 110 to 130 lb. Many thousands of miles of line have been newly ballasted, and on other lines ballast has been substituted for inferior material. A huge expenditure has been made to eliminate curves in tracks and to reduce grades. The mileage operated under the protection of block signals has been greatly increased. Bridges have been strengthened. The drainage of roadbeds has been improved. Indeed, tracks and other structures used in the operation of trains have been so bettered and strengthened that it has become possible all over the country to use heavier and more powerful locomotives, to haul longer trains and to operate on reliable schedules at increased speeds with a remarkable increase in safety of both employees and passengers.

Permitted Higher Speeds

"Advantages of these improvements in tracks and other facilities has been taken by the railways greatly to speed up their service. Long freight trains consisting of freight cars carrying fruits, vegetables and

other perishables are now moved on regular schedules at speeds which formerly could be attained only by passenger trains. The average speed of all freight trains has been increased 25 per cent. The speeds of many passenger trains in all parts of the country have been increased, and their 'on time' records have been improved.

"Has the public shown appreciation of this improvement in railway properties and service? It has, by expressing approval of the service, but not by indicating any willingness to pay rates for it proportionate to its quality and value. In spite of the improvement in service, a very large part of the local passenger business of the railways has been diverted to motor vehicles, and although there has been a large increase in the amount of travel in sleeping and parlor cars, there are still demands for legislation to deprive the railways of the $40,000,000 in revenues derived by them annually from the so-called 'surcharge' for travel in sleeping and parlor cars. The passenger business of most railways is now being handled at a loss, and those who persistently demand that the surcharge shall be abolished are demanding that it shall be handled at a still greater loss.

The Agitation for Waterways

"The situation as respects freight transportation is similar. Transportation by inland waterways would be much more expensive than by rail if the cost of providing and maintaining the waterways, as well as the rates paid by the shippers, were considered. It would be much slower and it could not be rendered at all in the northern parts of the country during a large part of the year. Nevertheless, there is widespread agitation for the development of inland waterways to divert traffic from the railways. Furthermore, there is constant and effective pressure for reductions of freight rates, especially on the products of agriculture and other industries which it is claimed are in a condition of depression.

"The result has been that the railways have not earned a fair return either upon the investment they previously had in their properties, or even on the large investment made within recent years in these improvements.

"The time is coming and, indeed, already is here, when the people of the United States must decide not merely what kind of transportation service they want, but what kind they are going to have. Their demands for good and constantly improving service are incompatible with their demands for the diversion of a large part of the traffic of the railways to other means of transportation and for lower rates on the traffic that is left. There seems to be no limit to the amount the public is willing to pay for other kinds of transportation that it wants. The interest and maintenance charges upon highways and waterways are analogous to the interest and maintenance costs of railway tracks. If we include the interest and maintenance costs of the highways, the American public is today paying probably three times as much for transportation by highway as by rail. Since transportation by rail is more essential and valuable to it than by all other means, why should there be this incessant struggle to get it to pay enough to enable the railways to furnish it the kind of service it demands from them? There is no magic in railway financing, management or operation which will make it possible for the railways indefinitely to render good service without rates proportionate to the service given."

The Organization of Track Forces

REPORT OF COMMITTEE

THE FIRST thing to consider in track maintenance is a proper organization. Track work cannot be efficiently performed without a suitable and carefully planned organization, together with an adequate number of the best-trained foremen obtainable. The interest of the foremen in the railroad and in their own work must be cultivated by their superior officers so that they, in turn, will require that interest in their men and thereby obtain better results from the labor expended. Foremen should be selected from men in the gangs in order to encourage industrious, capable laborers.

The general organization of track forces on American railroads consists of section gangs for ordinary routine work in specified territories and extra gangs for unusually heavy maintenance over a large territory that cannot be efficiently handled by the section gangs. The length of sections and the number of men per section are governed by various conditions, such as the number of tracks, the amount and character of traffic, any unusual conditions and quality of maintenance desired.

Equated Mileage

The method of determining the number of men per section varies on the different railroads. The most accurate general rule is to decide on the quality of maintenance to be attained, and determine the labor cost of maintaining one mile of main track to this standard, exclusive of rail renewals, heavy ballasting and other heavy maintenance. Then determine the cost of maintaining other units of work which are taken care of by the section forces and compare them with the cost of maintaining one mile of main track. When this has been done the various equated units of maintenance on a section can be added together to obtain the total equated mileage. After this has been done, determine the number of men needed to maintain a mile of main track and calculate the number of men needed on each section. This method is a close approximation, but there are several other things that must be considered, and additional men should be assigned to sections when unusual conditions are encountered, such as considerable stretches of yielding or unstable roadbed, unusually heavy or high-speed traffic, rock cuts that need frequent attention and severe grade and curve conditions.

In recent years the weight of track materials has been increased to take care of increased axle loads and increased traffic. This increase in weight of material has taxed the strength of ordinary section gangs, of from four to six men, to the point where it cannot always be handled safely and efficiently. The weight of rail in many main tracks today is from 100 to 136 lb. per yd. and many railroads have adopted a standard rail length of 39 ft. It is very difficult for the average section gang to change out one of these heavy rails or a frog of the same section without some additional help from the neighboring gang. To obtain such help requires time and may perhaps delay traffic while help

is being secured. It is also difficult to line track of the heavier construction, particularly in stone, slag or gravel-ballasted track, without calling for help from gangs from adjoining sections or using some mechanical device.

Advantages of Long Sections

The lengthening of sections with a corresponding man allowance per equated mile may be considered as a solution for increasing the number of men per gang. On some railroads the lengths of sections are increased after applying motor cars, but in many instances the man power was not increased in proportion to the increase in mileage, so this has not helped the situation for them. On other roads labor-saving machines have been installed to supplant man power, but frequently such labor saving machines cannot be efficiently operated with the existing number of men per gang, and consequently the maximum amount of work is not obtained from an expensive machine, which is not economical.

One railroad has been experimenting in a few locations, during the last two or three years, with the problem of combining two sections into one and placing a section foreman with an assistant foreman in charge of a combined gang in which the number of men is equal to the number previously allowed to both sections. This gang is sufficiently large, even during the winter when all gangs are reduced, to handle one of the heavy rails or frogs. During the summer the gangs have from 14 to 18 men each and can raise track or perform other section work that might require a small extra gang or the bunching of two section gangs. This arrangement requires the protection of only one set of flagmen instead of one for each small gang at two locations on similar work. In raising track it reduces the number of run-offs to half those that would be made by two gangs in separate locations, thereby increasing the number of feet of track raised and completed per man per day. By decreasing the number of flagmen, traffic is delayed less in proportion. Another advantage gained is that only one tool house, motor car and push car are needed in place of two of each.

There Are Also Disadvantages

The disadvantages are the inability always to obtain competent and efficient foremen who would be able to supervise a large section properly in all cases, especially during severe storms, and less personal inspection of each mile of main track by the foreman. This idea is still experimental, and there is a question as to how much territory one foreman can handle economically and supervise properly.

There are other conditions that might make it undesirable to lengthen sections. Some railroads now have single-track sections from 8 to 10 miles long, and it is doubtful whether they should be made longer. On other sections, there may be two or three interlocking plants which could not be properly supervised by one foreman, especially during storms. In fact, before lengthening sections all conditions should be weighed carefully to make sure that there will be sufficient supervision for safe and economical work.

Annual rail renewals, ballasting and other heavy track maintenance require more men than are found in the average section gang. In order to perform this work efficiently, it is necessary either to bunch section gangs or employ extra gangs. It is considered a better plan, where sufficent appropriation is available, to employ extra gangs for this purpose, as section gangs cannot be taken off their sections economically and safely for more than two or three days at one time. It is also expensive to carry men by train for a considerable distance to work of this character, on account of time lost in traveling to and from the work. It is also a source of considerable danger to transport gangs of men for long distances on motor cars to perform this type of work.

Proper Housing Important

Extra gangs can be housed either in portable camp equipment or permanent camps. If the work to be performed is over a comparatively short territory in a thickly-populated district, and where extra gangs are required throughout the year, it may be better to house such men in permanent camps, where sanitary laws can be more easily complied with. Where the work to be performed is scattered over a long subdivision, division or district, and suitable camp locations can be found, it is advisable to house the men in properly equipped portable camp outfits, so that such camps can be kept reasonably close to the work and avoid, as far as possible, loss of time traveling to and from their work.

It has been found advantageous on some railroads to move an extra gang from one roadmaster's or supervisor's division to another rather than confine it to one division. This is especially true of gangs employed for renewing rails or ballasting. It has been found that such gangs, where practically the same men can be held throughout the season, become very proficient in their particular work, and more efficient work can be obtained by holding the same organizations together for an entire season. The work on each dvision is scheduled, and each roadmaster or supervisor plans his work accordingly. By this arrangement a smaller amount of mechanical equipment is needed on a railroad for the type of work involved.

The use of mechanical devices to facilitate and improve maintenance has been instituted to a considerable degree on many railroads during the past few years. In order to obtain the greatest efficiency from such tools, and thereby obtain a proper return for the money invested, they must be properly maintained and manned. To maintain such tools a proper organization of mechanics must be developed and maintained under the supervision of the maintenance of way department and subject to the call of the supervisor or the roadmaster. Power tools that do not function properly and are out of order for a considerable time are a detriment rather than a help to a railroad.

Committee: A. A. Johnson, chairman, track engineer, D., L. & W., Hoboken, N. J.; E. C. Buhrer, supervisor, T. & O. C., Kenton, Ohio; M. H. Murphy, supervisor, C. & A., Mexico, Mo.; Chas. Kratoska, roadmaster, C. & N. W., Ames, Iowa; W. H. Haggerty, roadmaster, N. Y., N. H. & H., Harlem River, N. Y.; W. A. Clark, supervisor, Reading, Trenton Junction, N. J.; I. D. Talmadge, roadmaster, N. Y., O. & W., Middletown, N. Y.; H. B. Vess, editor, Employees' Bulletin, K. C. S., Kansas City, Mo.; and E. P. Safford, supervisor, N. Y. C., Silver Creek, N. Y.

Discussion

In answer to a question from J. J. Desmond (I.C.), Chairman Johnson said that the equation of mileage is essential to the proper organization of section forces but that the committee did not feel called upon to develop a formula for equated mileage, primarily because conditions differ so widely between various railroads that each road must develop an equation for itself. The discussion then turned largely to the suggestion of the committee that considerable economies could be effected by lenghtening

sections. H. P. Stafford (D.S.S.&A.) felt that such a step would result in reducing supervision and he maintained that intimate supervision is vital for track maintenance. While granting that the concentration of a larger number of men under the direction of a single foreman would be of advantage in the heavier operations carried on during the summer months, he contended that this would be offset by the necessity for a greater subdivision of supervision during the winter when the primary problem is the fighting of storms which involves a scattering of forces.

According to P. J. McAndrews (C.&N.W.), the low earnings of branch lines will undoubtedly force the roads to resort to further efforts to economize in the maintenance of such unprofitable properties by increasing the length of sections, but, in his opinion, it is unwise to apply this policy to main lines. Owing to the turnover of section forces, a considerable part of the foreman's time is required in the training of new men, and this becomes more difficult as the gangs are enlarged. The discussion developed the fact that relatively few changes have been made in the lengths of sections in recent years.

The principal objection to changing the lengths of sections was expressed succinctly by one speaker, who said that it is difficult to get the managements of the railroads to realize that a longer section requires a larger force, and that for this reason, the lengthening of sections will lead in some cases to the employment of smaller numbers of men in proportion to the mileage. J. W. Powers (N.Y.C.) said that most of the difficulty arises from the fact that, while most of the men now employed as foremen are well qualified to handle gangs of six or eight men, many of them would fail in handling larger forces. Another problem to which he pointed is that of recruiting men locally. There are many small stations, he said, where it is possible to recruit six or eight men resident in the locality, and changes of headquarters will seriously disrupt this arrangement for securing adequate forces.

An entirely different attitude toward the entire problem was expressed by William Shea (C.M.St.P.&P.) who predicted an early reorganization of the work performed by section gangs to make practicable the wider use of labor-saving machinery. He described a plan which he is now advocating on one of the important main lines of his road, whereby a special track maintenance gang would be organized to handle the larger items of ordinary track upkeep, such as tie renewals, spot surfacing, etc., leaving to the section gangs only such items of work as are ordinarily included under the heading of policing, this force to be deducted from the allotment of section forces. In his opinion, such a gang, equipped with a full complement of labor-saving machinery and equipment, will do a great deal of work more efficiently than it is now being done by regular section gangs, largely because it can use this equipment without being interrupted by the many details thrust on the average section force.

B. C. Dougherty (C.M.St.P.&P.) urged track supervisors to recognize that the introduction of labor-saving machinery necessarily implies a reduction of forces for it is only by an actual saving of labor that the purchase of power equipment may be justified. L. M. Denny (C.C.C.&St.L.) agreed with Mr. Dougherty in so far as this implied a reduction in the size of the gangs, but contended that it should not contemplate a reduction in supervision.

The Track Supply Exhibit

FIFTY-FOUR firms presented exhibits of equipment and materials employed in the construction and maintenance of tracks in rooms adjacent to the convention hall. As in past years, this exhibit consisted of full-size units, including more than a dozen devices presented for the first time. By reason of its practical character the exhibit attracted a great deal of attention from those railway men attending the meeting.

The officers of the Track Supply Association, who are responsible for the preparation and conduct of this exhibit, are: President, J. Howard Horn, sales manager, National Lock Washer Company, Newark, N. J.; vice-president, F. McAllister, president and general manager, Kalamazoo Railway Supply Company, Kalamazoo, Mich.; secretary-treasurer, A. H. Told, general manager, Positive Rail Anchor Company, Chicago; directors, W. W. Glosser, New York manager, electrical department, Hubbard & Co., New York; L. P. Shanahan, American Steel and Wire Company, Chicago; B. J. Wilson, western representative, The Pocket List of Railroad Officials, Chicago; D. J. Higgins, American Valve & Meter Company, Chicago; advisory directors, Elmer T. Howson, editor, *Railway Engineering and Maintenance*, Chicago, and R. A. Van Houten, vice-president, Sellers Manufacturing Company, Chicago; honorary director, J. P. Davis, president, Roadmasters' and Maintenance of Way Association.

At the annual meeting of the Association, held on Wednesday morning the following officers were elected for the ensuing year: President, F. E. McAllister; vice-president, L. P. Shanahan; secretary-treasurer, L. C. Ryan, Oxweld Railroad Service Company, Chicago; advisory directors, E. T. Howson, R. A. Van Houten; directors, W. W. Glosser, L. S. Walker, P. & M. Company, New York; and George T. Willard, Railroad Supply Company, Chicago.

The names of the companies exhibiting, together with a list of the materials exhibited and the names of their representatives follow:

Exhibiting Members

American Chain Company, Inc., Bridgeport, Conn.; guard rail clamps, one-piece guard rails, rail benders and compromise joints; J. J. O'Connell, A. H. Weston and W. I. Clock.

American Hoist & Derrick Company, St. Paul, Minn.; illustrations and photographs of ditchers, shovels, locomotive cranes, and supply-train cranes; Ward B. Maurer, Miss H. M. Hoeller and G. J. Heck.

American Fork & Hoe Company, Cleveland, Ohio; rail anchors and tapered rail-joint shims; A. F. Fifield, S. L. Henderson, J. T. Reagan, E. Keough, F. C. Stowell, J. Christie, R. C. Violett, J. J. Nolan and J. H. Dooling.

American Steel & Wire Company, Chicago; fencing, fence posts, signal wire, bonds, wire rope, nails, concrete reinforcement and snow-fence posts; T. Haskell, A. W. Froude, and C. A. Cochrane.

American Valve & Meter Company, Cincinnati, Ohio; wheel flange and rail lubricators; J. T. McGarry, J. W. McGarry, and D. J. Higgins.

American Switch Point Protector & Equipment Company, Inc., Denver, Colo.; switch point protector; W. L. Griffith.

Ames Shovel & Tool Company, Boston, Mass.; exhibit showing various steps in the manufacture of track shovels; N. E. Brooks and Norbert T. Jacobs.

Balkwill Manganese Crossing Company, Cleveland, Ohio; model of manganese crossing; S. Balkwill.

Bethlehem Steel Company, Bethlehem, Pa.; rail anchors, switch stands, hook-flange guard rail, gage rods and braced flangeway guard; N. E. Salsich, R. P. Deghuee, A. H. Kock, C. Cecil, J. L. Tygart, G. L. Moore, T. E. Hooper, and J. Tully.

Buda Company, Harvey, Ill.; motor cars, jacks and track liners; H. C. Beebe, A. J. Walch and A. H. Deimel.

Chase Appliance Company, New York; rail chair silencer and rail anchor tie plate; Warren Osborn.

Chipman Chemical Engineering Company, Bound Brook, N. J.; skid type weed sprayer, plans of other types of weed spraying equipment and dry chemical dusting cans; E. C. McClintic and A. F. DeVault.

Cullen-Friestedt Company, Chicago; motion picture of rail cranes in operation; E. P. Cullen, Thomas D. Crowley and William C. Bamber.

Duff Manufacturing Company, Pittsburgh, Pa.; track jacks, bridge jacks and tie spacers; C. N. Thulin, W. G. Robb, E. E. Thulin, Dave Evans and J. W. Gibson.

Edison, Thomas A., Inc., Bloomfield, N. J.; electric-lighted switch lamp, primary and storage battery cells and parts, night box for motor cars, and small hand lantern; F. S. Stallknecht, C. R. Heron and P. A. Garrity.

Fairbanks Morse & Co., Chicago; B. S. Spaulding, F. M. Condit, D. K. Lee, J. L. Jones, F. J. Lee, and E. C. Golladay.

Fairmont Railway Motors, Inc., Fairmont, Minn., Fairmont and Mudge products—light section car, standard section car, heavy duty section car, standard inspection car, cutaway model of motor car engine, wheel-axle-bearing assembly and model of trailer frame; Albert C. Force, W. F. Kasper, Robert D. Sinclair, K. K. Cavins, A. R. Fletcher, W. D. Brooks, E. R. Mason, John T. McMahon, and V. Pagett.

Hayes Track Appliance Company, Richmond, Ind.; models of derail; bumping posts and wheel stops; A. W. Booroom, E. L. Ruby and P. C. McClure.

Hubbard & Co., Pittsburgh, Pa.; shovels, track tools and nut locks; J. S. Wincrantz and W. W. Glosser.

Ingersoll-Rand Company, New York; literature on pneumatic tie tamper, rail drill, nutting machine, bonding drill, concrete breaker, spike puller and spike driver; W. H. Armstrong, G. W. Morrow, F. J. Ursem, T. H. Wiegand and G. E. Bridge.

Ingot Iron Railway Products Company, Middletown, Ohio; literature on ingot iron and culverts; A. W. Spaulding, H. M. Arrick, J. L. Young and A. W. Bryant.

Jordan Company, O. F., East Chicago, Ind.; moving pictures of spreader and track oiler; A. L. Greenabaum, J. C. Forbes, A. W. Banton, H. W. Protzeller and J. H. Mulholand.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.; motor cars, supervisor's track gage and level; F. E. McAllister, R. E. Keller, and L. W. Bates.

Keystone Grinder & Manufacturing Company, Pittsburgh, Pa.; hand and power-driven tool grinders; L. J. Cooney, S. S. Newman and Waldo E. Bugbee.

Lundie Engineering Corporation, New York; tie plates; L. B. Armstrong and G. W. Nibbe.

Maintenance Equipment Company, Chicago; switch point protector, model of friction car stop, and literature on hand and power rail layers, power track ballaster, flange and rail lubricator and steel fence posts; A. L. Arnold and J. A. Roche.

Mechanical Manufacturing Company, Chicago; model of bumping posts; H. E. Johnson.

National Highway Crossing Company, Burlington, Iowa; section of all-steel highway crossing; Fred Gerth, E. H. Batchelder, Jr., and Waldo E. Bugbee.

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Northwestern Motor Company, Eau Claire, Wis.; photographs of transmission drive for heavy-duty motor cars, light inspection cars, motor car discing equipment, gas-electric power plant and trailer; A. H. Nelson, Otis B. Duncan, Allan Datesman and G. H. Goodell.

Oxweld Railroad Service Company, Chicago; welding and cutting apparatus; L. C. Ryan, W. H. Kofmehl, J. E. Winslow, F. J. Duffie, W. E. Campbell, F. H. Lurquin, D. H. Pittman and L. A. Woodward.

P. & M. Company, Chicago; anti-rail creepers and bond-wire protectors; D. T. Hallberg, J. E. Mahoney, C. E. Webster, L. S. Walker, T. J. Byrne, S. M. Clancey, E. J. Van Patten and F. E. Rodman.

Pocket List of Railroad Officials, New York; copies of publication; B. J. Wilson.

Positive Rail Anchor Company, Chicago; girder type guard rail, rail anchors and guard rail plates and braces; A. H. Told and L. C. Ferguson.

Q. & C. Company, New York; guard rail clamp, compromise joint, switch point guard, flangeway guards and derails; J. L. Terry, L. Thomas, L. E. Hassman.

Rail Joint Company, New York; insulated joints, compromise joints, standard joints, head-free joints, reinforced joints, track liner and head-free rail; Alexander Chapman, D. L. Braine, H. C. Hickey, C. B. Griffin, J. N. Meade, Charles Jenkinson, E. B. Bishop, W. E. Cadd, Milton Markley, E. F. Schermerhorn and E. A. Condit, Jr.

Railroad Supply Company, Chicago; tie plates; George T. Willard and John Hensel.

Railway Purchases and Stores, Chicago; copies of Railway Purchases and Stores; Edward Wray and K. F. Sheeran.

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Reliance Manufacturing Company, Massillon, Ohio; spring washers; Robert Shireman, E. D. Cowlin, and H. R. Hanna.

Reade Manufacturing Company, Jersey City, N. J.; moving picture showing application of chemical weed killer; R. W. Pritchard.

Sellers Manufacturing Company, Chicago; wrought iron tie plates and wrought iron guard-rail tie plates; R. A. Van Houten, George M. Hogan and R. J. Platt.

Simmons-Boardman Publishing Company, New York; copies of *Railway Engineering and Maintenance* and *Railway Age*: Elmer T. Howson, F. C. Koch, W. S. Lacher, H. E. McCandless and J. M. Rutherford.

Skelton Shovel Company, Dunkirk, N. Y.; track shovels; E. W. McCarty, H. C. Branahl, Archie Milligan and R. J. Pinder.

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Woolery Machine Company, Minneapolis, Minn.; model of tie scoring machine, photographs, new control type weed burner, rail joint oiler and track bolt tightener; H. A. Rogers.

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What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities

QUESTIONS TO BE ANSWERED IN THE DECEMBER ISSUE

1. *What special tools should be furnished section gangs for winter use? Should these tools be returned to some central point in the spring?*

2. *What are the relative merits of the various methods of heating the aggregates for concrete on large jobs?*

3. *Is it economical to turn crossing planks where they become uneven through wear?*

4. *What troubles may be expected in operating internal combustion engines if a circulating system is not used for cooling?*

5. *How far from the track should fire guards be plowed to be effective?*

6. *What are the troubles to guard against in skylights and ventilators in shops and roundhouses during the winter? What should be done to obviate these troubles?*

7. *What is the best method of removing heavy falls of snow from large yards?*

8. *What special measures should be taken in the preparation of boarding cars for bridge or other gangs engaged in winter work?*

Power Trench Pumps

Are the advantages of power trench pumps sufficient to justify their being furnished for water service gangs?

Their Use Is Often Economical

By J. P. Hanley

Supervisor of Water Service, Illinois Central, Chicago

Where time is an important element, or where much ground water is apt to be encountered, power trench pumps are very desirable as a part of the equipment for water service gangs. We furnish these pumps for use in our larger terminals and at other places where experience has shown that they will be of value.

We prefer the diaphragm type of pump operated by a small gasoline power unit, as this combination is simple, easily handled and has little about it to get out of order. The diaphragm pump will lift water containing considerable grit or mud, with little wear of the moving parts.

Depends on Conditions

By Engineer Maintenance of Way

The value of any labor-saving device depends not only on the economies it can effect on any particular piece of work, but also on the extent to which it can be kept in service. This applies with particular force to the question as to furnishing power trench pumps for water service gangs, for conditions vary so radically as between different localities that no definite rule can be fixed. However, a little checking up on the amount of time spent in the operation of hand trench pumps on any division will give figures which can be used to determine the savings to be made with power pumps.

There is no doubt that the power trench pump is economical if it can be kept busy, and in many cases where it may not seem advisable to purchase such an outfit for any particular gang, it will be found advantageous to have one to be used by the building, bridge or water gangs as the need may arise. In such cases, the pump should be kept at division headquarters and sent to such gangs as need it. These pumps are often of great value to bridge gangs engaged in installing culverts or foundations for small bridge piers or abutments.

Compounding Curves to Save Throw

In relining main tracks on curves, are there any objections to introducing compound curves with small changes in radii to obviate large throws? What is the desirable limit of throw on well-ballasted track?

Speed of Trains Is Principal Factor

By Division Engineer

This problem is usually encountered when any given piece of track is to be put in condition for high-speed traffic, since speed accentuates the irregularities in line which may have existed in the track formerly, but which were not objectionable for the traffic requirements. In this class of work, it is often found that long curves can not be lined to a uniform radius without involving excessive throw of the track, which is not only expensive in the first instance, but leads to further expense by moving the track from the well-settled roadbed.

The problem, then, consists in balancing the advantages and disadvantages of throwing the track to a circular curve, or of introducing compound curves with small changes in radii at the points of compounding to obviate the necessity of the large throws. In making the decision, it is necessary to know the amount of throw required to bring the track to a true line without compounding, and also the number of compound curves that will be needed, together with their change in radii, to line the track without excessive throws. It will often be found that varying the curves by 10 or 15 min. will make a considerable difference in the throw and this change in radius is seldom objectionable in tracks carrying high-speed traffic.

So far as the alinement affects the trains passing over the track, there is no more objection to compounding a curve with 30 min. difference in the curvature of the adjoining arms than there is to using a 30 min. curve without spirals for speeds up to 80 miles an hour. The manual of the American Railway Engineering Association recommends that easement curves be used for all curves requiring an elevation of two inches or more for the highest permissible speed, and, according to the A.R.E.A. formula for computing superelevation, a 30 min. curve should have two inches of superelevation for speeds of 80 miles per hour.

The most of the troubles occasioned by the use of compound curves is due to the failure to elevate the branches of the curve correctly and to make the change of elevation at the right points, with run-offs of the proper lengths. Thus, assuming that a 1-deg. curve compounds to one of 1 deg. 15 min., the elevation of the 1-deg. position for 60 mi. per hour should be 2⅜ in., while that for the other should be 3 in., a difference of ⅝ in. For speeds of 75 mi. per hour the elevations would be 3¾ in. and 4⅜ in., respectively, or a difference of ⅞ in. The runoff should begin at the point of compound curve and should be made at the same rate as at the ends of simple curves, being made preferably on the branch with the lighter curvature.

In exceptional cases, where the difference in the degree of the adjacent curves is such as to require a difference of more than two inches in super-elevation, the two branches should be joined by an easement curve of the proper length.

From the foregoing, it will be seen that the permissible rate of change for compound curves depends on the speeds for which the superelevation is fixed, and that it reaches its smallest limits on tracks devoted solely to fast passenger or express service. For this reason, each case where it may seem desirable to compound the curve should be considered on its merits, since an attempt to apply an inflexible rule will result either in fixing the limit so small that the full advantage of saving in throw will not always be obtained, or the adoption of such a large change as to cause fast trains to lurch as they pass the points of compound curve when these occur at other than places where speeds are reduced.

It is sometimes difficult to introduce the desired compounds without spending what seems to be an undue amount of time on the work, but it is time well spent, since a day's work by a party of four or five men setting stakes to minimize the throw of the track may result in the saving of a day or two for a track gang of 75 men.

The points of compound curves should be marked in such a manner that they can always be located by the section foreman so that he can maintain the proper elevation on the different branches. Much of the dissatisfaction with compound curves is caused by failure to change the elevation properly as the rate of curvature changes, and this cannot be done unless the points where such changes should be made are known.

The judicious use of compound curves varying by 10 min. or 15 min. will often result in large savings in the cost of lining the track, and if the superelevation is maintained properly the track will ride well.

Care Should Be Taken in Their Use

By M. R. Hoagland
Office Engineer, Chicago & Alton, Chicago

The introduction of compound curves in main track to avoid excessive throwing depends upon a number of things, some of which are the kind of traffic, the speed, the length of curve, the grade, the location of the curve with respect to steep grades and the amount and kind of ballast in the track.

Where traffic consists chiefly of slow and heavy freight the compounding of curves is of small import while on track carrying fast freight or high-speed passenger trains, the compounding of curves is seldom justified, owing to the fact that the compounding almost invariably results in a racking effect which makes it difficult to hold the track in proper alignment. The point of compound curve is usually a bad spot in the track, from a maintenance standpoint.

Where the curve involved is short, the simple curve should be retained, but where long curves are involved and heavy and fast traffic is being handled, slight compounding to avoid disturbing the track is often justified. Where a curve is on a steep grade, or located at the foot of a steep grade where very high speed is attained, the introduction of compound curves should be avoided.

In the case of track well ballasted with stone or other first class material and carrying heavy traffic, the slight compounding of curves to avoid excessive throwing will in many cases be justified, providing other objectional features do not exist.

The desirable limit of throw on well ballasted track is, of course, zero. However, the justifiable limit should be such that the rail in the direction of throw will still rest on the old ballast section.

Removing Caps of Filled Trestles

When removing the decks of filled timber trestles is there any advantage in removing the caps as well as the stringers?

Not Always Necessary

By Superintendent of Bridges

While I have known of this practice being followed on some roads, and of trouble with soft track or sliding banks where it was not done, I have left the caps in place in many filled trestles without experiencing any trouble on that account. I removed the caps only on branch lines where the depth of ballast was such that the tops of the caps would extend above the shoulders of the roadbed if they were left in place, resulting not only in an unsightly appearance but also permitting water to settle into the embankment along their sides, softening the fill and rotting the caps.

In filling trestles, the dirt should be filled to the tops of the ties to allow for settling, except in the case of low trestles. After the embankment has settled, it will usually be found that there is a trough-like depression along the center line of the track, especially when the filling has been placed by side-dump cars. When the filling consists of clay or other impermeable materials, this trough should be filled by the section men as it develops, to avoid the formation of water pockets and

they should, at the same time, endeavor to work the material under the caps and stringers, although this can be done only to a small extent under the caps while the stringers are still in place. There is usually enough material on the shoulders to allow this to be done, since the dirt should be removed from the shoulders to the bottom of the stringers if it has not settled to that point. Such work can also be done to advantage as the fill reaches the under part of the caps or stringers.

Before removing the deck, the shoulders should be leveled off and sufficient cinders or gravel unloaded to carry the track, these materials being preferred on account of the ease with which they may be worked in surfacing the track after its weight is thrown upon the embankment.

Should Be Removed

By E. M. GRIME

Engineer of Water Service, Northern Pacific, St. Paul, Minn.

By all means remove the caps as well as any old bracing or other timber than can be conveniently taken out of the fill. Bridge caps, while unfit for further service, have been known to remain in place on top of the piling or framed bents for years after a trestle has been filled. While it may be assumed that the filling material flows around the piles or posts and beneath the caps, it takes many years for it to become thoroughly consolidated under the cap, and the result is that soft spots continually develop in the roadbed, especially after heavy rains. For years thereafter, the maintenance of this particular stretch of track is more costly than it would have been if the caps had been removed. It is certainly far more necessary to remove these old caps than it is to clear the right of way of tree stumps or other debris before a new embankment is placed, as is commonly required on new construction.

Limitations for Spring Frogs

What limitations, if any, are there in the use of spring frogs on curved as well as tangent track?

Depends on the Amount of Traffic on Both Routes

By L. J. DRUMELLER

Assistant Division Engineer, Chesapeake & Ohio, Russell, Ky.

The use of spring frogs is highly desirable at some locations. This is true at the connections of passing and other secondary tracks with the main line. Consideration should be given to the amount of traffic over the frog through both routes, for at the ends of double track and important and constantly-used passing tracks, a rigid frog should be used in preference to a spring frog.

It has been found, by replacing rigid frogs with spring frogs at the ends of passing and secondary tracks when laying new rail through main line switches, that the spring frogs outlive the rigid frogs. The use of spring frogs also provides much smoother riding track. This is true on both curved and tangent tracks.

Should Not Be Used on Curves

By J. MORGAN

Supervisor, Central of Georgia, Leeds, Ga.

There are no limitations in the use of spring frogs on tangent tracks, but I consider that such frogs should not be used on the outer rail of curved tracks and think it better to eliminate them entirely from curves. As long as the frogs are in good working order, with the spring rails fitting up closely, they are as safe as rigid frogs on curves, but if the spring rail stands open from any cause, such as the creeping of the rail or the lodgement of a piece of metal or other material between the spring rail and the point of the frog, the spring frog becomes unsafe on the outer side of a curve.

There Are Few Limitations

By ROADMASTER

Objections have been made to the use of spring frogs on the outer side of curved track on the theory that an accident is apt to occur if the spring rail is forced open from any cause, when a train is making a main track facing point movement over the frog. This is largely a fallacy, as the spring rail cannot open enough, under normal conditions, to allow the wheels to drop inside the track and the guard rail will provide as much protection against the wheels taking the wrong side of the point, as if a rigid frog were used. It is good practice to avoid locating any frog, spring or rigid, on a curve if it can be avoided, and special attention should be paid to the guard rail on the main track when it is necessary to place a frog in curved track.

Rigid frogs of small angle should preferably be used at the ends of double track or where two heavy traffic lines diverge, both to permit higher speeds through the turnout and to prevent excessive wear of the moving parts, which would be introduced by the use of spring frogs.

Tie Plates for Softwood Ties

The A.R.E.A. recommends a width of 7 in. or 7½ in. for tie plates for hardwood ties, but makes no recommendation as regards softwood ties. Are these widths sufficient for the latter, and if not, what widths should be used?

Should Be Wider For Softwood Ties

By J. MORGAN

Supervisor, Central of Georgia, Leeds, Ala.

The recommended width is sufficient for hardwood ties, but for soft woods the plates should be wide enough to cover the face of the tie so as to provide a bearing on its entire width; otherwise the plate will soon cut down into the tie, forming a pocket to hold water, which sets up decay and shortens the life of the tie. The average tie has a face from 8 in. to 9 in. wide, and where softwood ties are used, the plates should be the same width. There is quite a loss in ties on roads with considerable curvature on account of the tie plates being too narrow to hold the rail in place on top of the tie instead of cutting down into it.

Tie Plates Should Be Eight Inches Wide

By V. H. SHORE

Yard Foreman, Atchison, Topeka & Santa Fe., Dodge City, Kan.

The width of a tie plate should be the same as the width of a standard sawed tie, or eight inches, whether hard or soft wood. There can be no fixed standard for hewn ties or for branch lines or sidings as they vary too much in width.

Since all our sawed main track ties and many of our hewed ties are of a standard width of eight inches, most of our ties would be protected by a full-width tie plate, as the majority of our second class ties run a little less than eight inches wide.

I can see no disadvantage in a tie plate being slightly wider than the tie, which would be the case on ties used for sidings, yards and branch lines if an eight

inch width tie plate were adopted as standard. If objections arose as to standard eight-inch wide tie plate being too wide where smaller ties were used, we could provide a narrower tie plate for them.

Use Wider Plates or Secure Them Rigidly to the Ties

By Division Engineer

As is well known, tie plates sink into the ties after they have been in service a comparatively short time, and this action has always been attributed to the compression of the wood fibres under the loads. Recent investigations and studies by Dr. Hermann von Schrenk show that in many cases this is due to the abrasion of the wood under the tie plate rather than to crushing and that it takes place with either hardwood or softwood ties.

Whatever may be the cause, the sinking of the plates below the surface of the tie forms pockets which hold water, this water finding its way under the plate. This water will hasten the abrasion of the wood under the plate and will also cause decay, which will be rapid in the case of untreated softwood ties.

The remedy for this is either to make the tie plates wide enough to cover the face of the tie, or to adopt some means to prevent the formation of these pockets. The experience of those roads which have adopted the practice of fastening the tie plate to the ties independently of the spikes which hold the rail, shows that this arrests, if it does not wholly prevent, the sinking of the tie plate by fastening the tie plates securely to the tie, so that no abrasive motion takes place. This practice seems worthy of further consideration, since the use of tie plates as wide as the tie will not stop the abrasion of the wood, although it will retard it to some extent and will prevent the formation of pockets to retain water.

Preparation for Winter

In preparing the track for winter, what special precautions should be taken, especially where heaving is apt to occur?

A Number of Things Should Be Done

By Roadmaster

In addition to putting the track in good line and surface before freezing weather begins, there are a number of other things to be done, which will save much trouble later on. Ballast should be removed from the tops of the ties, especially along the rails and also from around rail anchors, so that, in case it is necessary to change out a broken or damaged rail, or to shim the track on account of heaving, the work will not be delayed by picking frozen ballast from around the spikes and anchors. The ballast should also be removed from below the tops of the ties under switch points, guard rails and spring frogs so that they will not become clogged with ice. These precautions take little time as the gang is working over the track and the cost will usually be saved many times over during the winter season.

So far as heaving is concerned, any radical steps to eliminate this troublesome occurrence should be taken during the working season, rather than as a last-minute job before winter. Heaving is caused by lack of drainage, and if drainage conditions have not been improved where heaving is to be expected very little can be done to prevent it by starting late in the working season. Where it is known that heaving is apt to take place, a sufficient supply of shims and braces should be provided before freezing weather begins and these should either be stored in the section toolhouse or at some other place near where they will be used. If the latter practice is adopted, they should be kept where they will be protected from the weather and from trespassers, for shims make very desirable fuel for tramps on cold days.

Drainage Is Most Important

By V. H. Shore

Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

Where heaving is apt to occur in winter, the principal precaution to be taken before freezing is to have the track well drained so as to reduce moisture to a minimum in the track, as water is the cause of heaving. Rail shims of different thicknesses should be cut and bored ready to apply where the track heaves. If at all possible, snow should be removed from track that has given trouble from heaving and not allowed to melt on it in the earlier part of the season.

Heaving is usually caused by some form of clay in the top of the roadbed or subgrade that absorbs and retains much water and is slow to dry out. When water freezes, it expands and increases in volume, hence we have heaved track where considerable moisture is found in the roadbed when the roadbed becomes frozen. Where only patches of the clay occur in the roadbed and the cost is not prohibitive, it should be replaced by good soil that will drain easily or by some form of light ballast, but where the cost would be too great to replace it, there is no other alternative than to take care of the heaving by methods similar to those described above.

Protection of Reinforcing Bars from Rust

What is the best method of protecting reinforcing bars from rust when unloaded where they are to be used? What is the best method of removing rust which may have formed on them?

Should Be Protected From Weather

By I. L. Simmons

Bridge Engineer, Chicago, Rock Island & Pacific, Chicago

The protection of reinforcing bars from rust should begin before they are received where they are to be used. Where these bars are furnished from stocks carried by the store department, that department should be impressed with the importance of storing them under cover there so that they will be protected from corrosive influences. This is our practice, and in case the bars are rusted so badly that they cannot be made fit for use without an undue amount of work when they are received they are shipped back to the storehouse to be replaced by clean bars.

On the site of the work, the amount of protection to be provided will depend on the length of time which is apt to elapse between the time they are received and when they are to be used. They should always be piled so that they will not be in contact with the ground, and some sort of cover should be provided if they are not to be used promptly.

There are two kinds of rust on reinforcing bars: One, where the surface is only slightly corroded and the other where the rusting has progressed to such an extent as to form scale. In the former case, the bars can be easily cleaned with a wire brush, but the scale presents a more serious problem, not only on

account of the expense of removing it, but also on account of the reduction in the section of the bar. It is our practice, when such bars must be used, to remove the scale by hammering them and then to caliper the bars to see whether or not the loss in section is sufficient to make it necessary to use a greater number of bars to secure the desired reinforcement. I have known extreme cases where 1-in. bars were reduced in section to ¾ in.

If the bars are properly protected from the time they are received by the railroad until they are installed, there need be little trouble with rust, and these precautions are much less expensive than removing the rust after it has formed.

Prevention Is Better Than Cure

By Supervisor of Bridges

The cost of removing rust from reinforcing rods is so great and the operation consumes so much time that both time and money can be saved by protecting the bars from rust at all times until they are in the forms ready for the concrete. To furnish this protection, the bars should be stored on platforms of some kind to keep them away from the ground or cinders and they should be covered to protect them effectively from the rain.

In case the bars become badly rusted, about the only way that they can be cleaned is to loosen the rust with hammers and then to finish the cleaning with wire brushes. The importance of clean reinforcing bars is well understood by all who have anything to do with reinforced concrete. The safest and cheapest way to provide clean bars is to prevent the formation of rust, rather than being put to the necessity of removing it.

Inspection of Heating Plants

What special inspection should be made of heating plants before the advent of cold weather?

Plants Should Be in Charge of One Man

By A. T. Hawk

Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

Some years ago considerable trouble was experienced with the various heating plants on our road, these usually occurring when the plants were placed in service in the fall. At that time, the inspection and care of these plants were under the division forces, and the results obtained varied with the experience of these forces in heating requirements and practices.

In order to make an improvement in this respect a man was sent out to make an inspection of the plants over the entire road, starting on the northern lines in the spring and working south. The man selected for the work was one who had been engaged in similar work on another road and who had also been connected with firms furnishing and installing heating layouts. As the inspection of each plant was completed, material was ordered to make the necessary repairs or additions to insure satisfactory results and the responsibility was placed on the division forces which were checked up to see that the work had been done. Among the most frequent causes of trouble were cracked boiler fronts, broken fire pots or grates, faulty insulation and leaking pipes.

In connection with the inspection, detailed instructions were issued as to the correct maintenance of the various installations to insure uniformity. A marked improvement was evident the first year this practice was inaugurated, and the general inspector was given a large force of men whom he directed in the work. As conditions improved this force was gradually reduced.

As the work progressed, attention was given to the piping in shops, not only for heating but for other purposes, and one shop was selected in which to make radical improvements. Here, in addition to poorly insulated and leaking pipes, it was found that exhaust steam was being introduced into pipe lines without removing the oil from lubrication, and that some of the pipes had become almost completely clogged by the deposit of the oil.

The boiler settings were also looked after. These were usually of brick and the defects consisted of cracks which allowed cold air to enter the firebox. These cracks were filled and the boiler settings plastered on the outside. Feedwater heaters were also inspected and cleaned out, and the filters were put in good shape. This was productive of large savings, as the raising of the temperature of feedwater 10 deg. means a saving of one per cent in fuel. Dampers were also installed in the smoke stacks and these were fitted with levers, that were so arranged that the openings could be controlled as desired.

The total savings in fuel effected by the work on the first shop were so great that a similar program was adopted for all of the shops and also at roundhouses where steam was used. Vacuum heating systems were installed in the larger shops and feedwater heaters were provided at all points where two or more boilers were operated. Traps were placed to collect condensed steam and return it to the boilers, insuring pure water and making further savings in fuel. After the heating and steam plants had been put in good condition, they were easily maintained by providing systematic inspection.

In connection with the improvements at the shops, air lines were inspected, and in some cases were found to be leaking so badly that it was cheaper to install new lines than to repair the old ones. Owing to the rapidity with which such lines corrode when placed under ground around shops and yards, the new lines were placed above ground whenever possible. When necessary to place them below the surface, they were covered with asbestos or magnesium and this in turn was wrapped with canvas and asphalt roofing, covered with paint to make them waterproof.

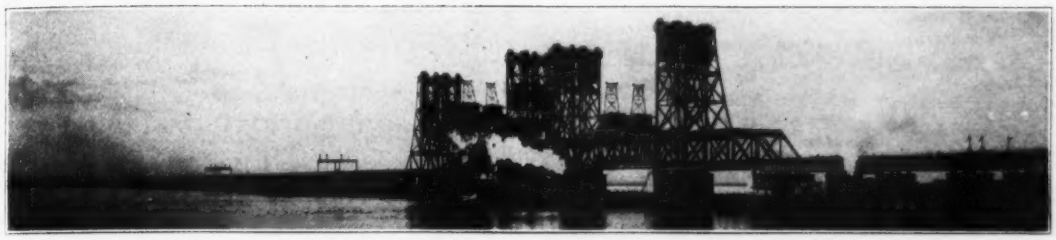
The best time for making inspections of heating plants is near the close of the season during which they are being used, since this permits their observation under service and leads to the detection of defects which cannot be seen at other times. The improvements we have effected have been due, in large measure, to the policy of having the inspection of these plants under the supervision and control of one man.

Handled by Division Forces

By Assistant Engineer of Buildings

We have the heating plants in our various buildings inspected early in the fall, in time to make any necessary repairs before the plants are to be placed in service. This is done by the division forces who, at the time of making the inspection, instruct the users of the plant as to its proper care and operation. In addition to this, our building inspectors also inspect the heating facilities whenever they visit any of the buildings, and make notes as to any repairs or changes that should be made. Instructions based on these notes are then issued to the division officers for their guidance. We find that most of the troubles in heating are occasioned by improper handling or carelessness in operation.

New and Improved Devices



Wrench Indicates Force Applied

THE influence of uniform tension in track bolts on the failures of joints and bolts, with the consequent battering of the rail ends, and the maintenance of the proper expansion spaces between the rails, has long been understood by those in charge of track, but it has been difficult to know when the desired tension has been secured, owing to the variations in the efforts exerted by different men using the same length of wrench, or even by the same man at different times. To obviate this difficulty the Du-Wel Steel Products Company, Chicago, has placed on the market what it has designated as the Gilken Torsion wrench, which shows on a dial the effort applied, from which a measure of the tension in the bolt may be ascertained. The dial may be graduated to show either the force exerted, or the approximate tension secured in a bolt of given diameter by the application of that force, as the user may desire.

Gilken Torsion Wrench

The wrench is five feet long and the lower part is of comparatively heavy cross section to furnish rigidity. Above this part, the remainder of the wrench is a rod with a uniform diameter of one inch, which will allow slight flexure, varying with the force applied in tightening bolts, but not sufficient to interfere with the operation of the wrench. The wrench is made of tool steel to prevent its taking a permanent set.

A flat steel bar, trussed laterally, is welded to the rigid part of the wrench but is left free along the round stem. This bar terminates in a rack which operates a pinion behind the dial and causes the indicator to move in accordance with the flexure in the stem of the wrench when force is applied to tighten the bolt. Knowing the force necessary to produce a given flexure in a rod of the size and material of which the stem of the wrench is made, the dial may be graduated to show that force, or, by the knowledge of the tension set up in the bolt by the application of a given force in the tightening of the nut, the dial may be graduated to show that tension. The tool is designed to protect it from injury while being used, or while being carried with the other tools to and from the work.

This wrench has been used on the Atchison, Topeka & Santa Fe, where it was employed to tighten the bolts on certain test sections of track where the effects of bolts with uniform tension are being studied.

Conveyor Increases Efficiency of Power Ballast Cleaner

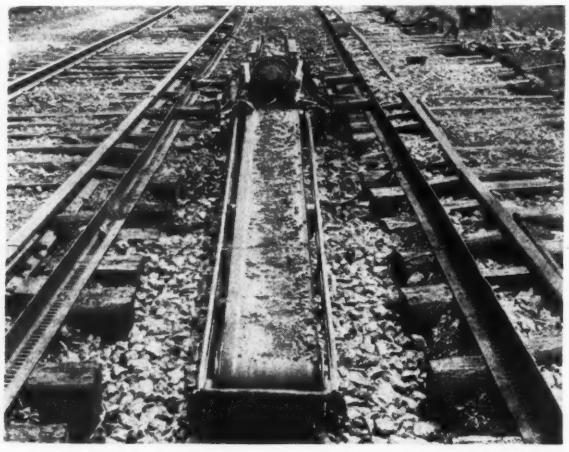
A FURTHER reduction in the labor of cleaning ballast by the use of the McWilliams "mole" has been made possible by the addition of a power conveyor which cuts down the force required for its operation. The mole, as described in *Railway Engineering and Maintenance* for November, 1926, page 482, "crawls" along in the intertrack space and virtually works its way through the ballast normally

The Conveyor in Position to Deliver Refuse

placed between the tracks or dumped there for cleaning by trackmen who have removed it from between the ties of adjoining tracks. In moving through this ballast, the machine passes the stone over reciprocating screens for the purpose of removing the dirt, cinders, etc., which are delivered at the rear of the machine for removal.

In the earlier models of the mole provision was made for collecting this foreign matter in bags or boxes which had to be carried away by hand. A

belt conveyor has now been provided by means of which this dirt may be delivered to the roadbed shoulder and deposited there without any hand labor. The conveyor is attached at the rear of the mole, so that the throwing of one lever disconnects the drive and permits one man to swing it to clear in from 5 to 10 sec. The conveyor will swing to 180 deg., delivering to either side of the roadway, as desired. The drive is taken off the rear screw conveyor shaft and is entirely protected from dirt. The complete assembly can be entirely removed within a few minutes, if it is desired to transport the mole from one point to another, or to operate it without the conveyor and collect the dirt in baskets, as with the earlier models.



To Clear Trains the Conveyor Is Swung Into Line Between Tracks

All rollers and pulleys on this attachment are mounted on ball bearings; consequently very little power is required to drive it, and with this conveyor the operating force of the mole can be cut to four men, including the operator and flagman. The mole is manufactured by the Railway Maintenance Corporation, Pittsburgh, Pa.

Chipman Offers Atlas "NP" in Dusters for Use Dry

A RECENT development in the application of Atlas "NP" or non-poisonous weed killer is its use in the dry form. This chemical, which is manufactured by the Chipman Chemical Engineering Company, Bound Brook, N. J., is readily shipped as a dry powder, thus reducing the cost of transportation, and, after being delivered, it may be either dissolved for use in spraying or applied dry. The dry application has been found of particular advantage in cleaning up small patches of weeds such as would not be reached by track spraying equipment and which must be disposed of by section gangs.

For use in this way, the powder is now being packed in small cans with a sifter top so that it can be dusted on the weeds by hand. All that is necessary is to remove the cover from the "duster" and shake the dust uniformly over the weeds. The action of the dry powder is said to be just as certain and complete as the liquid spray because the necessary moisture is absorbed from the air or supplied by the plants themselves.

After using, the tops should be replaced on the can as the chemical quickly absorbs moisture and cakes so that it cannot be used dry. This, however, does not affect its plant-killing power, and it can be used by dissolving in water and spraying.

The use of Atlas "NP" in dry form is particularly adapted to the disposal of weed growths on yard tracks or around cattle guards, trestles, switch stands, signals or other places where spraying cannot be done readily.

New Paint Spray Gun Has Two Special Features

TWO NEW features of importance have been added in the new Type EF paint and lacquer spray gun manufactured by the Alexander Milburn Company, Baltimore, Md. The first of these is a dialed head which permits the operator to obtain any desired spray promptly without first making tests. This new head permits numerous spray adjustments from a circular spray to a fan spray of a wider field than has been possible heretofore with spray guns.

New Calibrated Paint Spray Gun

The second feature, which permits adjustment of the volume of paint used, is a series of indicator numerals on the paint valve plunger, and a pointer which is operated as the operator turns the adjustment button provided. Through these new improvements the gun is fully calibrated, making it possible before starting work for the operator to adjust it, both for the character of the spray and the amount of paint to be used, so as to produce the best results in the particular class of work which he is undertaking.

The frame of the new gun is made of Tobin bronze forgings with a tensile strength of 50,000 lb. per sq. in. This makes the gun practically indestructible and insures that it will not get out of alinement. It also makes it light in weight. This latter feature, combined with the long trigger provided, and the delicate balance of the gun, make it easy to handle on long operations without fatigue. The gun can be used for primers, fillers and finishing materials, and will not only spray the finest material, but is also adapted for applying heavy anticorrosive paint.

Aside from these improvements the new gun is similar to the Milburn Type E gun. In order to make it possible to bring the Type E gun up-to-date, both the new dialed air control valves and the calibrated paint valve plunger have been adapted to this gun, and can be inserted in any of the Type E guns which may be returned to the company for this purpose.

A NEW FUEL RECORD.—The greatest efficiency for any corresponding period on record in the use of fuel by road locomotives was attained by the Class 1 railroads of this country in the first six months of 1928, according to reports just filed by the railroads with the Interstate Commerce Commission.

With the Associations

The Engineering Association

The Committee on Yards and Terminals held a meeting at the Chateau Frontenac at Quebec, Que., on October 24 to 26, inclusive. After the meeting a visit was made to the modernized classification yard of the Boston & Maine at Mechanicville, N. Y., in response to an invitation extended by R. J. Hammond, assistant to the president of the Boston & Maine, and H. F. Burch, assistant general manager of the Delaware & Hudson.

The Committee on Track held a meeting at Detroit on September 18 and 19, coincident with the annual convention of the Roadmasters' and Maintenance of Way Association. This has become an established practice with this committee as a means of affording a contact with the Roadmasters' association and to permit the members of the Committee on Track to study the exhibit of the Track Supply Association. Members of the committee and Secretary Fritch attended the annual dinner of the Roadmasters' and Track Supply associations on September 19.

Metropolitan Track Supervisors' Club

The next meeting of the Metropolitan Track Supervisors' Club will be held on Thursday, October 18, at 3 p. m., at Keen's Chop House, 72 West Thirty-sixth Street, New York. Special attention is called to the change from the usual day, time and place of meeting, a change which was approved at the annual meeting in June. At that meeting also, W. E. Gadd of the Rail Joint Company, was appointed secretary-treasurer of the club, succeeding L. S. Walker of the P. & M. Company.

The subject for discussion at the October meeting will be, "The Preservation of Ties in Track," and the principal speaker will be G. C. Stephenson, superintendent of the Port Reading Tie Treating Plant. The usual dinner will follow the meeting at 6 p. m.

Bridge and Building Association

The thirty-eighth annual convention of the American Railway Bridge and Building Association will be held at Hotel Statler, Boston, on October 23-25. Through the courtesy of the Canadian National and the Boston & Maine, a special train will be furnished from Chicago to Boston, via Montreal, traversing the Central Vermont from St. Johns, Que., to White River Junction, Me., and the B. & M. from the latter point to Boston. The train will leave Chicago at 9:30 a. m. on Sunday, Oct. 21, arriving at Montreal at 10:00 a. m. the following morning and at Boston at 8:00 p. m. All persons expecting to travel on the train are required to make reservations through the secretary of the association in order that ample accommodations may be provided.

The program for the convention is as follows:

Tuesday, October 23

10:00 a. m. Convention called to order.
Invocation.
Address of welcome: George Hannauer, president, Boston & Maine.
Response: C. E. Smith, vice-president, New York, New Haven & Hartford, and past-president, American Railway Bridge and Building Association.

10:30 a. m. President's address: F. C. Baluss, engineer of bridges and buildings, Duluth, Missabe & Northern.
Report of secretary-treasurer.
Appointment of special committees.
Announcements by Committee on Arrangements.

11:00 a. m. Report of Committee on the Relative Merits of Jacking or Tunneling Through a Roadbed Under Traffic, as Compared with Other Methods of Placing Culvert Pipe; F. H. Masters, assistant chief engineer, Elgin, Joliet & Eastern, chairman.

Tuesday Afternoon

2:00 p. m. Report of Committee on the Use of Motor Trucks for Handling Bridge and Building Material and Supplies: J. S. Huntoon, assistant bridge engineer, Michigan Central, chairman.

3:00 p. m. Paper: "The Southern Pacific's Proposed Bridge Crossing Suisun Bay," by H. I. Benjamin, assistant engineer, Southern Pacific.

3:30 p. m. Report of Committee on Recommendations for Promoting Co-operation Between the Stores Department and Field Forces: L. M. Bates, division engineer, Chicago & North Western, chairman.

4:30 p. m. Adjourn to visit exhibit of Bridge and Building Supply Men's Association.

Tuesday Evening

7:30 p. m. Illustrated talks on the New England flood of 1927, by W. J. Backes, chief engineer, Boston & Maine, and C. E. Donaldson, supervisor bridges and buildings, Central Vermont.

Wednesday, October 24

9:30 a. m. Report of Committee on Control of Motor Car Operation with Respect to the Prevention of Accidents: W. A. Batey, general bridge and building inspector, Union Pacific, chairman.

10:45 a. m. Paper: "The Wrecking and Salvaging of Railway Buildings," by W. T. Krausch, engineer of buildings, Chicago, Burlington & Quincy.
Report of Nominating Committee.

Wednesday Afternoon

2:00 p. m. Report of Committee on Organization and Equipment for Handling Emergency Bridge, Building and Water Service Work: C. D. Turley, supervisor of track, Illinois Central, chairman.

3:00 p. m. Address (speaker to be announced later).

3:30 p. m. Report of Committee on Economical Operation and Maintenance of Water Stations: R. C. Bardwell, superintendent water service, Chesapeake & Ohio, chairman.

Wednesday Evening

6:30 p. m. Annual dinner of the American Railway Bridge and Building Association and the Bridge and Building Supply Men's Association.

Thursday, October 25

9:00 a. m. Report of Committee on Construction and Placing of Concrete Unit-Built Slabs for Various Purposes; H. A. Gerst, assistant bridge engineer, Great Northern, chairman.

10:00 a. m. Report of Membership Committee.
Selection of the next meeting place.
Election and installation of officers.
Adjournment.

After the adjournment on Thursday afternoon a trip will be made to points of interest in Boston, while on Friday an all-day trip will be made by motor coaches outside the city, visiting many places of historic interest.

The Material Market

WITH ORDERS for 45,500 tons from the Chesapeake & Ohio, for 40,000 tons from the Union Pacific, and 15,000 tons from the Great Northern, placed late in September, the season of annual rail purchases has been definitely opened, and with inquiries out for the requirements of several other roads, it is anticipated that further assignment of tonnages will soon be made. It is, of course, too soon to make a comparison of orders placed this year with those of a year ago, particularly as some of the largest buyers of rail have not yet been heard from.

The demand for track fastenings, which has been fairly steady in recent weeks, is now somewhat greater. The largest single item of interest in this field is the anticipated orders by the Pennsylvania for 305,000 tie plates, and 66,800 pairs of angle bars, in addition to a sizeable number of track bolts. Bids on this material were closed on September 27.

Iron and Steel Prices Per 100 Lb.

	August		September	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$2.80	$2.80	$2.80	$2.80
Track bolts	3.80	3.80	3.80	3.80
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.15	2.15	2.15	2.15
Boat spikes	3.00	3.00	3.00	3.00
Plain wire	2.40	2.45	2.40	2.45
Wire nails, keg	2.55	2.60	2.55	2.60
Barb. wire, galv.	3.20	3.25	3.20	3.25
C. I. pipe, 6 in. to 12 in. ton		$42.20 to 43.20		$42.20 to 43.20
Plates	1.90	2.00	$1.85 to 1.95	2.00 to 2.10
Shapes	1.90	2.00	1.85 to 1.95	2.00 to 2.10
Bars, soft steel	1.90	2.00	1.85 to 1.95	2.00 to 2.10
Rivets, struc	2.90	3.00	2.90	3.00
Con. bars, billet	$1.95 to 2.00		1.90 to 2.00	
Con. bars, rail	1.75	1.85	1.75	1.85
Rails per gross ton f.o.b. mills	43.00	43.00	43.00	43.00

Few Changes in Prices

Save in the case of structural steel, prices have been steady and no changes were reported during the past month. With the upward movement of other steel products in recent months, an advance in the price of track spikes was anticipated in some quarters, but it remains at $2.80 per 100-lb. keg. Wire and wire products have been steady, except for some local cutting of the price of nails. Cast iron pipe quotations remain unchanged.

It is in the large tonnage items, plates, shapes and bars, that the market trend is more directly reflected in prices. According to announcements of the leading manufacturers, prices were to advance for all fourth-quarter business to a range from $1.90 to $2.00 per 100 lb., Pittsburgh, with $2.00 to $2.10 the corresponding figures for Chicago. The new levels of prices are now pretty well established in the mid-western market but the Pittsburgh price levels range between $1.85 and $1.95. This is ascribed to a reluctance of buyers to contract for fourth-quarter needs and a willingness of some sellers to postpone the date at which new prices were to become effective.

Scrap Prices Per Gross Ton at Chicago

	August	September
Relaying rail (including angle bars)	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	14.75 to 15.25	16.00 to 16.50
Rails less than 3 ft. long	15.25 to 15.75	17.00 to 17.50
Frogs and switches cut apart	13.75 to 14.25	14.75 to 15.25
Steel angle bars	15.00 to 15.50	15.75 to 16.25

The scrap market has undergone a marked strengthening during the month owing to an unanticipated shortage which caught some dealers with orders that they had difficulty in filling. As a result, prices are from $0.75 to $1.75 per ton higher than they were a month ago.

Efforts on the part of the principal associations of soft-wood manufacturers to curtail production, and thus avoid the surplus stocks which have broken prices in the past, appear to have been fairly successful. Statistics for the first 36 weeks of 1928, issued by the National Lumber Manufacturers' Association, show that orders were seven per cent higher and shipments six per cent greater than production, which means that stocks have been reduced.

West coast mills have undertaken to place themselves in an even more favorable position by enforced shut downs during part of September to further reduce stocks. Whether or not these influences have an important bearing, the fact remains that prices are higher as seen in the tables here shown.

Southern Pine Mill Prices

	August	September
Flooring, 1x4, B and better, flat	$39.54	$40.18
Boards, 1x8, No. 1	32.87	31.43
Dimension, 2x4, 16, No. 1, common	28.18	29.04
Dimension, 2x10, 16, No. 1, common	28.89	29.50
Dimension, 2x4, 16, No. 2, common	24.82	25.47
Dimension, 2x10, 16, No. 2, common	25.59	25.39

Douglas Fir Mill Prices

	August	September
Flooring, 1x4, B and better, flat	$24.50	$25.75
Boards, 1x8, No. 1	17.50	17.25
Dimension, 2x4, 16, No. 1, common	18.75	19.00
Dimension, 2x10, 16, No. 1, common	18.50	18.75
Dimension, 3x3 to 4x12, No. 1, common	19.50	19.75
Dimension, 5x5 to 12x12, No. 1, common rough	16.50	17.50

August is a month of large demand for portland cement and shipments totaled 21,970,000 bbl., as compared with a production of 18,730,000 bbl., or 93.1 per cent of capacity. As a consequence, stocks on hand September 1 totaled 19,340,000 bbl., compared with 22,571,000 bbl., at the beginning of August. But even with this reduction, stocks at the close of August were 18.7 per cent higher than a year ago. The price for portland cement shown in the table for New Orleans is 20 cents lower than that shown in last month's table, otherwise there were no changes. Prices are per barrel in carload lots, not including package.

New York	$2.03	Minneapolis	$2.22
Pittsburgh	2.04	Denver	2.85
New Orleans	2.20	Dallas	2.40
Chicago	2.05	San Francisco	2.41
Cincinnati	2.22	Montreal	1.41

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 23-25, 1928, Hotel Statler, Boston, Mass.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 5-7, 1929, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 22-24, 1929, Louisville, Ky.

Bridge and Building Supply Men's Association.—W. D. Waugh, secretary, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds; secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, April, 1929.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 19-21, 1929, Chicago.

Track Supply Association.—L. C. Ryan, secretary. Oxweld Railroad Service Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

Railway News

Briefly Told

Henry Palmeri, a track laborer at Elmira, N. Y., believes in the value of physical exercise. After completing his day's work of driving spikes and tamping ties, he serves as captain and outstanding star of the Elmira high school track team.

The number of employees reported by the Class I railways as of the middle of May of the current years was 1,709,721 and the total compensation for the month was $242,880,334, according to the Interstate Commerce Commission's monthly statement of railways wage statistics. The total number of employees decreased 83,420, or 4.65 per cent, from the total in the corresponding month in 1927, while the total compensation decreased only 2.51, owing to the fact that May, 1928, had one more working day than May, 1927, and also to an increase in the average hourly rate. Of the total decrease of 83,420 employees, 23,063, or 27.6 per cent, was accounted for in the maintenance of way and structures group.

They do things differently in South Africa, where the courts aid the railways in impressing on travelers the importance of the injunction to "Cross Crossings Cautiously." In a recent case at Natal, the driver of a steam wagon, who persisted in his attempts to cross a track in spite of repeated warnings, was prosecuted and fined £10, with the alternative of a month's imprisonment. In another case at Capetown, where a flagman's signals were ignored and a motor car was driven into a train at a crossing, the driver was fined £5. In the Cape province, a youth 18 years of age, whose wagon was seriously damaged by a train, was fined £3 when he acknowledged that he had not kept a good lookout.

The sending of a blue print by wire recently resulted in the saving of 24 hours or more in the delivery of a shipment of 10 tons of steel from the plant of Joseph T. Ryerson in Chicago to La Rose, Ill., a distance of 116 miles. An order for the steel, accompanied by a blue print, sent from Tulsa, Okla., to St. Louis, Mo., was found on its receipt at the latter city to be of such character as to require repeating it to Chicago, which was done by telephotograph. On receipt of the order at the shop, the work was completed in 1 hr. 25 min. by doubling the crews and the payment of bonuses. By the co-operation of the Pennsylvania and the Atchison, Topeka & Santa Fe, a car was furnished promptly and the shipment left Chicago the same night, arriving at La Rose at 4:20 the next morning. The blue print was about 7 in. by 9 in. and contained four simple diagrams in addition to shop marks.

The Atchison, Topeka & Santa Fe has been authorized by the Interstate Commission to acquire control of the Kansas City, Mexico & Orient, the report expressing the opinion that the acquisition will be advantageous to the Orient, which has never been able to finance itself, to the shippers because of the assurance of a regular, dependable and permanent service, and to the Santa Fe, since the two roads are complementary and supplementary to each other, not more than 5 per cent of the Orient's traffic being competitive with the Santa Fe's lines. The total consideration to be paid is $14,507,500, and while this is more than the commission's valuation of the property as of June 30, 1919, the commission points out that additions and betterments since the date of valuation would raise the amount to a sum in excess of the price to be paid, and also that the valuations do not include anything for the 320 miles in Mexico.

The Louisiana Public Service Commission, acting on the report of its engineering adviser, will accept the two-station plan of passenger terminal facilities at New Orleans, according to an announcement by the chairman of the commission. Under this arrangement permission will be granted the Illinois Central to construct a new passenger station on Rampart street, while an agreement is expected to be reached for the construction of a station to be used by the Louisville & Nashville and the Southern. The cost of construction of the Illinois Central station, including the elimination of grade crossings, is estimated at $8,000,000. The terminal engineer employed by the commission reported that the two-station plan, as opposed to the union-station plan, will require the purchase of less property, less abandonment of present facilities, less new construction, and will avoid congestion which might result on the New Orleans Public Belt through the use of certain portions of its line by passenger trains.

The states of Idaho, Oregon and Washington are attempting to compel the Union Pacific to construct a 125-mile extension along the Snake river from Lewiston, Idaho, to Homestead, Wash. At a hearing, which was granted by the Interstate Commerce Commission on petition of the Idaho Public Utilities Commission, the Public Service Commission of Oregon and the Washington Department of Public Works, which was opened at Lewiston, Idaho, on August 27, before Commissioner Frank McManamy and Examiner John L. Rogers, the total cost of the line was estimated as $16,933,822 by C. C. Van Arsdel, consulting engineer for the commissions, while A. C. Spencer, general solicitor of the Oregon-Washington Railroad & Navigation Company, stated that the railroad's estimate was about $25,000,000. Early in the hearing, Col. Robert H. McBride, assistant chief of supplies of the War department, presented a communication from that department which stated that such a railroad is considered necessary for national defense in the Northwest and pointed out the ease with which it could be defended. Witnesses testified that the railroad would reduce transportation costs and open up additional agricultural, timber and mineral resources along the Snake river.

The bell of the Effie Afton, the steamer which was burned and sunk in 1856 after colliding with one of the piers of the Chicago, Rock Island & Pacific bridge across the Mississippi river between Rock Island, Ill., and Davenport, Ia., was recovered on July 3 by a United States Government dredge engaged in deepening the Channel. The bell, which weighed over 700 lb., and which was said to have been of ornate design, was stolen after its discovery and broken up for junk, but most of the pieces were found and are now in the possession of Major C. L. Hall, chief of the United States district engineers at Rock Island. The bridge, which was the first to be erected over the navigable portion of the Mississippi river, had been in service only three weeks at the time of the collision and was partially wrecked and burned as a result of the accident. In a suit instituted by the owners of the steamer against the bridge company asking for damages and also for the condemnation of the bridge as a public nuisance, Abraham Lincoln was attorney for the defendant, and while the jury failed to agree, most of the members voted to dismiss the case. The United States Supreme Court rendered a decision in 1862 which affirmed the right of the railways of the country to erect bridges over navigable streams.

Construction News

The Atlantic Coast Line has been authorized by the Interstate Commerce Commission to build an 8.4-mile extension from Clewiston, Fla., at an estimated cost of $172,785.

The Baltimore & Ohio has reached an agreement with the city of Gary, Ind., for the construction of a highway viaduct over the tracks of the railroad at a point known as Miller in that city. Sixty-five per cent of the total cost of the viaduct will be borne by the railroad.

A contract has been awarded to the Vang Construction Company, Cumberland, Md., for the construction of piers and abutments for two bridges at Tippecanoe, Ohio. Approximately $40,000 is involved in the contract.

The Bessemer & Lake Erie plans to construct additional water supply facilities at Branchtown, Pa. The work is expected to cost approximately $32,700.

The Boston & Albany has awarded a contract to the J. F. Fitzgerald Construction Company, Boston, Mass., for the installation of four circular wet-type ash pits at its Beacon Park yard in Boston, Mass.

The Canadian National has awarded a contract to the Foundation Jupiter Company, Ltd., Halifax, N. S., for the construction of its new station and adjoining hotel at Halifax. The new hotel, which will have 168 rooms with provision for expansion to an additional 150, will be called the "Nova Scotia." The station building will be 160 ft. by 100 ft. and of the same style and design as the hotel. Access from the station to the hotel will be from the station concourse through an arcade.

The Canadian Pacific plans the construction of a double-deck bridge over the Saskatchewan river, north of Nipawin, Sask. The bridge will be 1,840 ft. in length and the lower deck will be used for highway traffic.

The Chicago, Burlington & Quincy has awarded a contract for the construction of a five-stall brick roundhouse at Peoria, Ill., to W. M. Allen & Sons, Peoria, at a cost of about $25,000.

The Cincinnati, New Orleans & Texas Pacific has awarded a contract for the construction of a second main track between Lexington, Ky., and the Kentucky river, about 22 miles, to the Bates & Rogers Construction Co., Chicago. Another contract for the construction of a second main track between the Kentucky river and Danville, Ky., about 13 miles, has been let to the Brooks-Calloway Company, Atlanta, Ga.

The Cleveland Union Terminals has awarded a contract to the Lundorf-Bicknell Company, Chicago, for the erection of a building to be known as the Medical Arts Building in the new terminal development at Cleveland.

A contract has also been awarded to the McClintic-Marshall Company, Pittsburgh, Pa., for steel work in connection with track elevation at East Cleveland, Ohio.

The Florida East Coast has been authorized by the Interstate Commerce Commission to construct a 9.5-mile line from Belleglade-Chosen, Fla., to Lake Harbor, at an estimated construction cost of $384,340.

The Graysonia, Nashville & Ashdown has awarded a contract for the construction of five miles of branch line in the vicinity of Saratoga, Ark., to the Horton-Price Construction Company, Texarkana, Ark.

The Great Northern has awarded a contract to the Railway Engineering Equipment Company, Chicago, for a direct steaming system for installation in a 24-stall enginehouse at Interbay (Seattle), Wash. This system will be installed without smoke jacks or a heating system. Installation of the direct steaming equipment, together with a hot water washing and filling system, will be made by the F. W. Miller Heating Company, Chicago.

The Hocking Valley has authorized an expenditure of $1,800,000 for new track and yard facilities on its Toledo division. Approximately $850,000 of the authorization covers the construction of a new southbound yard at Walbridge, Ohio. The relocation of a public highway and the erection of a 100,000-gal. water supply tank and mains are the only parts of this work to be done under contract. The highway work has been awarded to the Fritz-Rumer-Cooke Company, Columbus, Ohio, while bids on the water supply facilities were opened on September 6. The remaining $950,000 of the authorization will be expended on the construction of second track between Longley, Ohio, and LeMoyne, a distance of about 19 miles. This will complete second track work on the Toledo division from Columbus to Walbridge. The Fritz-Rumer-Cooke Company has also received a contract covering grading, masonry and track laying on one section of the line, while a contract for similar work on the remaining section has been awarded to the Sturm & Dillard Company, Columbus.

The Houston North Shore has applied to the Interstate Commerce Commission for authority to construct a nine-mile extension from its main line near Green's Bayou, Tex., in the form of a loop to a connection with the main line at a point near the west side of the San Jacinto river.

The Illinois Central has awarded a contract for the construction of a grain elevator at Omaha, Neb., to the L. A. Stinson Company, Chicago. The elevator proper will consist of 24 storage tanks which will have a combined capacity of 1,200,000 bu.

The Long Island has been ordered by the Public Service Commission of New York to eliminate four grade crossings at Valley Stream, N. Y. The work will be done at Franklin and Rockaway avenues and Rockaway road on the Montauk division and at Scranton avenue on the West Hempstead branch.

The Missouri Pacific plans the construction with its own forces of stockyards and accompanying facilities at Haswell, Colo., at a cost of about $25,000. Included in the project will be the construction of 3,000 ft. of sidings, live stock pens covering an area of 45 acres, loading and branding chutes, feed racks and water storage tanks.

The Mound City & Eastern has awarded the general construction of its line from Mound City, S. D., to Leola, 70 miles, to the Johnig & Davis Construction Company, Britton, S. D. Construction was started simultaneously at Mound City and Leola on September 20. Present plans call for the construction of a line with maximum grades of 1.1 per cent and a total expenditure of $1,600,000.

The New York Central has awarded a contract to James Stewart & Co., New York, for the construction of an underground passageway between its office building on Lexington avenue, New York, and Grand Central Terminal. The work is expected to cost approximately $125,000.

This road plans a $2,500,000 expenditure for improvements to its Mott Haven yards, New York, the project being in connection with the provision of additional facilities for handling passenger equipment. Bids are now being sought for the initial work, involving the construction of a retaining wall and a new milk platform and driveways with access from Park avenue by means of a new bridge and viaduct across the Harlem division tracks. Plans also call for the construction of a five-story building to house yard forces of the Pullman Company and the road's commissary department. New trackage arrangements will also be installed to facilitate operation between Mott Haven and Grand Central terminal.

A contract has been awarded to Heyl & Patterson, Pittsburgh, Pa., for the installation of an additional all-electric car dumper on the docks of the Ohio Central Lines at Toledo, Ohio. The equipment is to be furnished by the General Electric Company.

The city council of Toledo, Ohio, has adopted an ordinance providing for the issuance of $500,000 of bonds for the construction of a grade separation structure at Central avenue and the tracks of this company and the Michigan Central at Toledo.

Bids have been received for work in connection with the roofing of openings over its depressed tracks along Park avenue between Fifty-seventh and Seventy-second streets, New York. The work is estimated to cost approximately $200,000.

Several contracts have recently been awarded by this road, as follows: Con-

struction of a grain drier for an elevator at Weehawken, N. J., to the Folwell Engineering Company, Chicago; elimination of a grade crossing at Brighton, N. Y., and construction of towers and power house at Dewitt, N. Y., to Wm. M. Ballard, Inc., New York; elimination of grade crossing at Nepperhan, N. Y., to Lyons-Slattery Co., Inc., New York; extension of platforms, canopies and fences at Botanical Gardens, N. Y., Mt. Vernon, Bronxville, Tuckahoe, Crestwood, Scarsdale, Hartsdale and White Plains, to Edward J. Duffy Co., Inc., New York; extension of canopy and construction of subway at Ossining, N. Y., and addition of second story to portion of baggage and mail room at Utica, N. Y., to H. R. Beebe, Inc., Utica, N. Y.; alterations to yard at Mott Haven, N. Y., to Babor-Comeau & Co., Inc., New York; installation of feeders for electric light and power facilities for platforms and canopies, at Buffalo, N. Y., to Fischbach & Moore, Inc., New York.

The New York, New Haven & Hartford has recently awarded six contracts, involving estimated expenditures totalling $280,000. The largest, involving approximately $75,000, went to Coleman Bros., Boston, Mass., for substructure work in connection with alterations to the West Squantum Street bridge, Quincy, Mass. A second contract for the construction of seven additional stalls to the enginehouse at Maybrook, N. Y., at a cost of about $55,000, was awarded to the H. Wales Lines Company, Meriden, Conn., while a third, involving an estimated expenditure of about $50,000 for the substructure and deck of a new highway bridge at North Windham, Conn., was given to V. N. Famiglietti & Sons, Providence, R. I. Of two other contracts, each involving an expenditure of approximately $35,000, one, for the extension of four enginehouse stalls at Southampton street, Boston, Mass., went to the Tredennick-Billings Company, Boston, Mass., and the other, for alterations and additions to a coal pocket at South Boston, Mass., went to the Wilbur C. Hudson Corporation, New York. The sixth award was made to the Curtis-Quillen Company, Providence, R. I., for substructure work to cost about $30,000 in connection with the reconstruction of a bridge over Clinton street, Fall River, Mass.

In addition to these contracts, this road has awarded a contract to the Turner Construction Company, Boston, Mass., for the erection of a warehouse to be used by the Providence Produce Warehouse Company at Providence, R. I. The building will be 965 ft. by 60 ft., with a two-story portion at one end. Approximately $500,000 is involved in the contract.

The Norfolk & Western plans for the elimination of grade crossings in the eastern part of Columbus, O., have been approved by the city and work on the project is expected to be undertaken immediately. The total cost is estimated at $4,000,000.

The Pennsylvania has awarded a contract for the construction of a produce terminal at Fort Wayne, Ind., at a total cost of about $300,000 to the Buesching & Hagerman Co., Fort Wayne.

Seven contracts, involving estimated total expenditures of approximately $700,000, have recently been awarded by this road for various construction projects at different points on its line. The list of projects and firms to which contracts have been awarded follows: Construction of a thawing plant to cost about $325,000 in connection with the new coal pier at South Philadelphia, Pa., to the Newhall Company, Cleveland O.; construction of an overhead bridge at a cost of approximately $110,000 to eliminate three grade crossings at Tullytown, Pa., to H. F. Curtis, Philadelphia, Pa.; grading, masonry, and track work, estimated to cost about $90,000 in connection with the extension of the Economy branch between Baden and Economy, Pa., to the H. E. Culbertson Co., Cleveland, O.; construction of culverts, bridges and track work incident to the elimination of grade crossings between Warwood and Short Creek, W. Va., at an estimated cost of $70,000 to the Crosoau Construction Co., Brownsville, Pa.; construction of foundation for produce warehouse at Sixteenth Street, Pittsburgh, Pa., to cost about $55,000 to the John F. Casey Co., Pittsburgh, Pa.; construction of a corn-sheller plant to cost approximately $45,000 at the Girard Point elevator, Philadelphia, Pa., to the James Stewart Corp., Chicago; installation of protection screens for overhead bridges in connection with electrification from Philadelphia to West Chester, Pa., to the Kauffman Construction Co., Philadelphia, Pa. A contract has also been awarded to Deakman & Wells, Jersey City, N. J., for the completion of work on the new concourse at the Journal Square station, Jersey City. Steel work on the new concourse has already been erected but the concrete, brick work, roof and interior and exterior fittings remain to be completed. Extensive alterations and renovations will also be carried out in the old station. The new concourse will be 60 by 240 ft.

A contract was also awarded to the Erection Corporation, Pittsburgh, Pa., for steel work in connection with the construction of the auction house at its new produce terminal at Pittsburgh, Pa. A second contract, involving about $45,000 for track laying and line changes from Glen Osborne, Pa., to Shields, went to the Newhall Company, Cleveland, Ohio. Two grade crossing elimination contracts, one for work, involving about $23,000 at Penns Neck, N. J., and the other, for work involving approximately $26,000 at Bordentown, Pa., went, respectively, to James F. Brogan & Company, and to Young Bros., Inc., both of Philadelphia, Pa.

The Pennsylvania and the Lehigh Valley have jointly awarded two contracts, involving approximately $500,000, for furnishing and erecting a portion of the steel work on the new bridge over Newark Bay, at Greenville, N. J. These two awards each involved $250,000, one being given to the Bethlehem Steel Company, Bethlehem, Pa., and the other to the American Bridge Company, Philadelphia, Pa.

The Pittsburgh & West Virginia has awarded a contract to Winston Brothers, Minneapolis, Minn., for the construction of an extension from Cochran's Mill, Pa., to Connellsville, about 38 miles. The total cost of the project is estimated at $12,800,000.

The Rutland plans the construction of a new heating plant at Malone, N. Y. Bids have been received on work in connection with the erection of the boiler and chimney, while those for piping and building alterations have not yet been invited. The project is expected to cost approximately $35,000.

The St. Louis-San Francisco has awarded a contract to the Gerhardt Construction Company, St. Louis, Mo., for the construction of a one-story brick and concrete passenger station at Pittsburg, Kan., at a cost of about $25,000. A contract for the construction of a one-story brick and stucco combined freight and passenger station at Rollo, Mo., has been let to Grant Wyatt, St. Louis, at a cost of about $40,000.

The Southern Pacific has been authorized by the Interstate Commerce Commission to build a new line and a bridge across Suisun bay, near San Francisco, Calif., subject to approval of the Secretary of War, and to abandon car ferry service across the Strait of Carquinez. The project is estimated to cost $11,548,500.

The Toledo, Peoria & Western has awarded a contract to the Austin Company, Cleveland, Ohio, for the construction of buildings for mechanical facilities at East Peoria, Ill. Company forces will be employed in the construction of a new yard at this point.

The Union Pacific has awarded a contract for the construction of a machine shop at Cedar City, Utah, to Ryberg-Sorenson, Inc., Salt Lake City, Utah. A contract has also been awarded to E. R. Green, Hastings, Neb., for the construction of a passenger station and accompanying facilities at Gering, Neb. The old station at that point will be moved to South Mitchell, Neb. A contract has been let to W. K. Martin, Kansas City, Mo., for the construction of a freight station at Kansas City, Kan.

The Wabash has awarded a contract for the remodeling of Inbound Freight House, No. 2, at St. Louis, Mo., to the MacDonald Construction Company, St. Louis, at a cost of about $75,000.

The Waco, Beaumont, Trinity & Sabine plans the construction of a roundhouse at Beaumont, Tex., in connection with the extension of its line from Beaumont to Waco and Port Arthur.

Supply Trade News

General

The Bates & Rogers Construction Company, Chicago, has opened an office at 75 West street, New York, with **Roy E. Ross,** district manager, in charge.

The **Winston Bros. Company** and the **Winston-Dear Company,** Minneapolis, Minn., have consolidated as the **Winston Bros. Company,** constructors and engineers.

The Niagara Metal Stamping Corporation, Niagara Falls, N. Y., manufacturer of brass and aluminum signs and other metal products, has changed its name to **Premax Products, Inc.** No change in policy or personnel is contemplated.

The Chicago Pneumatic Tool Company, New York, has completed a modern foundry at Franklin, Pa., where all gray iron castings for its compressors and engines will be made. The foundry building is 130 ft. by 220 ft. and a storage shed 60 ft. by 330 ft. has also been erected. The total cost of the buildings and equipment was over $400,000.

The Ames Shovel & Tool Company, whose general office has been in Boston, Mass., since 1901, on August 10 moved its office to its factory at North Easton, Mass. The company was reorganized recently, **Oliver Ames** remaining as vice-president, and with other officers as follows: **William A. Ready,** president; **Norbert T. Jacobs,** general sales manager; **Albert H. Daggett,** treasurer; and **Victor D. Vickery,** secretary.

The Paige & Jones Chemical Company, New York, has purchased from the American Water Softener Company, Philadelphia, the patent rights and good-will of the lime-soda water-softening business of that company, which will hereafter be manufactured and sold by the former company. **W. T. Runcie** and **H. C. Waugh,** formerly sales manager and chief engineer, respectively, of the American company, have joined the organization of the Paige & Jones Chemical Company.

Personal

W. G. Willcoxon has been appointed sales representative of the MacLean-Fogg Lock Nut Company, Chicago.

Hal F. Wright, in addition to his other duties, has been appointed assistant to the general manager of sales of the American Chain Company and associate companies, with headquarters at Bridgeport, Conn.

H. L. Rogers has been appointed special representative for **The Philip Carey Company,** Cincinnati, O., in charge of sales of Elastite third rail covering, Elastite trunking and other similar products. Mr. Rogers has been identified with The Philip Carey Company for a number of years, during which period he has acted as chief engineer of the Elastite Products division and, more recently, as manager of its railroad department.

C. E. Plummer has been appointed chief chemical and metallurgical engineer of the Robert W. Hunt Company, with headquarters at Chicago.

L. R. Beatty has been appointed agent for the Northwest Engineering Company, Chicago, with headquarters at 327 South Twelfth street, Philadelphia, specializing on the application of that company's machines to industrial uses.

A. L. Datesman has been appointed sales representative for Otis B. Duncan, manufacturers agent for the Northwestern Motor Company, Eau Claire, Wis., with headquarters at 53 West Jackson Boulevard, Chicago, effective October 1. Mr. Datesman was formerly connected with the purchasing department of the Pennsylvania at Pittsburgh, Pa., and Philadelphia, and more recently was associated with the Railway Products Company, Pittsburgh.

Trade Publications

Performance on the Job.—Fairmont Railway Motors, Inc., has issued a folder illustrating and containing a brief description of the Fairmont and Mudge motor cars manufactured by that concern for various phases of maintenance of way work.

The Carbic Light.—The Oxweld Acetylene Company, New York, has issued a 16 page booklet in vest-pocket size, describing and illustrating its portable floodlights and the processed carbide which is used for the production of gas in these lights.

Northwestern Crawler Equipment.—A 40-page catalog issued by the Northwest Engineering Company, Chicago, contains full descriptions, supplemented by illustrations, of its crawler cranes, draglines and power shovels, in sizes ranging from ½ to 1¼ cu. yd. capacity.

Portable Floodlights.—The Oxweld Acetylene Company, New York, has issued a 16-page pocket-size booklet describing and illustrating its complete line of portable carbic lights for night illumination in carrying out construction and maintenance work.

Celite for Concrete.—The Celite Products Company, Los Angeles, Cal., has issued a 16-page illustrated bulletin, No. 339, which describes the functioning of Celite in improving the workability of concrete and its effect on the uniformity, water-tightness, and appearance of the finished product.

Industrial Tractors and Trucks—The Elwell-Parker Electric Company, Cleveland, Ohio, has issued an attractively printed catalog of 40 pages describing and illustrating its tractors, trucks and tractor cranes for transporting and handling materials in freight stations, store houses and warehouses.

Personal Mention

Engineering

Charles E. Cate, assistant to the chief engineer of the Southern Pacific of Mexico, with headquarters at Guadalajara, Jal., has been promoted to chief engineer, with headquarters at the same point, to succeed **E. B. Sloan,** who has been promoted to fiscal representative and general agent with headquarters in the City of Mexico.

E. L. Anderson, assistant engineer on the St. Louis-San Francisco at Springfield, Mo., has been promoted to division engineer, with headquarters at the same point, to succeed **J. M. Sills,** who has resigned to become associated with the brokerage firm of John Muir & Co., New York.

Mr. Sills was born on January 28, 1881, at Kansas City, Mo., and graduated from the University of Kansas in 1903. He entered railway service during his vacation as an employee in the engineering department of the Kansas City, Ft. Scott & Memphis (now a part of the St. Louis-San Francisco), and after the completion of his college work, became a rodman on the

J. M. Sills

Frisco, where he was advanced successively to transitman, assistant engineer and resident engineer, serving on both maintenance and construction. He was later promoted to district engineer, with headquarters at Springfield. Mr. Sills was promoted to assistant chief engineer in 1918 and in the following year resumed his former position of district engineer at Springfield, continuing in that position until 1921, when the office was abolished. Since that time he was division engineer of the Eastern division with headquarters at Springfield until the time of his resignation on September 1.

Henry F. Brown, assistant district engineer of the Northern Pacific lines east of Mandan, N. D., whose promotion to district engineer of the same territory, with headquarters at St. Paul,

Minn., was noted in the September issue, was born in New York on April 6, 1884, and graduated from the Sheffield Scientific School of Yale University in 1905. He entered railway service in September of the following year as an instrument man on the Northern Pacific and was promoted to resident engineer on construction in April, 1907. He served in that capacity and also as district engineer on construction in Washington and Montana until 1910, when he was appointed assistant engineer. Mr. Brown was later promoted to assistant district engineer of maintenance of way, which position he was holding at the time of promotion to district engineer in charge of the lines east of Mandan on August 20.

J. B. Dawson, whose promotion to division engineer of the New Mexico division of the Southern Pacific, with headquarters at El Paso, Tex., was noted in the August issue, was born in Ohio on May 13, 1882, and was educated in various technical schools. He

J. B. Dawson

entered railway service in 1902 with the Chicago, Milwaukee & St. Paul and later in the same year entered the employ of consulting engineers in Cleveland, O., where he was engaged on railroad, steamship and mining projects. In 1904 he re-entered railway service as engineer in charge of grade separation construction on the Erie, and from 1907 to 1909 was assistant county engineer at Cleveland in charge of the construction of the Dennison-Harvard viaduct. Mr. Dawson entered the service of the Southern Pacific in 1910 and since that time has served in various positions in the engineering department, holding the position of assistant division engineer of the Coast division, with headquarters at San Francisco, Cal., at the time of his recent promotion to division engineer.

A. H. Tasker, whose promotion to division engineer on the Conemaugh division of the Pennsylvania, with headquarters at Pittsburgh, Pa., was noted in the August issue, was born on August 23, 1886, at Brooklyn, N. Y. After attending Bates College and Yale University from 1906 to 1910, he entered the service of the Pennsylvania in July, 1910, as a signal apprentice, with headquarters at Philadelphia, Pa. In May, 1913, he became inspector of signals at the same point, and in November of the same year he was promoted to assistant supervisor of signals on the West Jersey & Sea Shore, a subsidiary of the Pennsylvania. On August 15, 1914, he was transferred to the New York division of the Pennsylvania, and on June 1, 1920, was promoted to supervisor of telegraph and signals on the Middle division at Altoona, Pa. On November 10, 1927, he was transferred to the Pittsburgh division at Pittsburgh, where he remained until his recent promotion to division engineer.

General

Paul J. Neff, general superintendent of the Eastern district of the Missouri Pacific, with headquarters at St. Louis, Mo., an engineer by training and experience, has been promoted to assistant to the president, with headquarters in the same city. Mr. Neff was born at St. Louis on July 14, 1884, and graduated from the University of Kansas in 1906. He entered railway service in February, 1907, as a rodman on the St. Louis-San Francisco at Joplin, Mo., advancing by successive promotions to assistant engineer and serving in that capacity, and as engineer of construction, until June, 1917, when he was promoted to district engineer at Springfield, Mo. From September, 1918, until December, 1919, during federal control of the railways, he was corporate chief engineer of the Frisco, with headquar-

Paul J. Neff

ters at St. Louis. During 1920, he was general manager of the Wichita Falls, Ranger & Fort Worth and the Wichita Falls & Southern, with headquarters at Ranger, Tex. In February, 1921, he was appointed chief engineer of the Texas lines of the Frisco, with headquarters at Fort Worth, Tex., and in December of the following year he was appointed assistant to the president of the International-Great Northern, with headquarters at Houston, Tex., this being followed in February, 1925, by his promotion to assistant executive vice-president, with headquarters at the same point. Mr. Neff entered the service of the Missouri Pacific proper in June, 1926, as general superintendent of the Eastern district, with headquarters at St. Louis, which position he was holding at the time of his promotion to assistant to the president on September 1.

Track

S. W. Van Pelt, section foreman on the Missouri Pacific at Independence, Kan., has been promoted to roadmaster, with headquarters at Independence, Kan., to succeed **G. W. Tull,** transferred.

R. K. Stoneberger, section foreman on the St. Louis-San Francisco at Rosedale, Kan., has been promoted to acting roadmaster on the Kansas City terminals to succeed **B. H. Crosland,** whose promotion to assistant division engineer on the Northern division, with headquarters at Fort Scott, Kan., was noted in the September issue. **Garrett Honey,** steel gang foreman, has been promoted to acting roadmaster on the Southwestern division, with headquarters at Lewis, Okla., to take the place of **A. Lewis,** who has been granted a leave of absence.

Charles H. Gruver, roadmaster on the Cedar Rapids-Minnesota division of the Chicago, Rock Island & Pacific, with headquarters at Manly, Ia., whose retirement was noted in the August issue, was born at West Union, Ia., in 1857. Mr. Gruver entered the service of the Rock Island in 1877 as a section laborer and 19 months later was made a section foreman. He was promoted to assistant roadmaster in 1893 and in the following year he was promoted to roadmaster, which position he was holding at the time of his retirement on June 30, after a continuous service of over 50 years with the Rock Island.

G. Thompson has been appointed roadmaster on the Drummondville and Oxford subdivisions of the Quebec district of the Canadian Pacific, with headquarters at Farnham, Que., succeeding **W. H. Gibson,** who has been transferred to the Lyndonville and Newport subdivisions, with headquarters at the same point, to replace **W. M. Bell,** who has been transferred to the Laurentain division, with headquarters at Trois Rivieres, Que. **O. Kirkland,** roadmaster on the Quebec district, with headquarters at Montreal, Que., has been transferred to Farnham to succeed **T. Landers,** who has retired.

Fred A. Chinquist, whose promotion to district roadmaster on the Great Northern, with headquarters at St. Cloud, Minn., was noted in the May issue, was born on May 8, 1892, at Minneapolis, Minn., and graduated from the Minneapolis Business College. He entered railway service on April 7, 1911, as an extra gang laborer on the Great Northern and was promoted to extra gang timekeeper 10 days later,

remaining in that position until January 1, 1913, when he was promoted to assistant extra gang foreman. Mr. Chinquist was promoted to section foreman on July 1, 1914, and served in that capacity and as extra gang foreman until his promotion to district roadmaster.

A. L. Clark has been appointed supervisor on the Grand Trunk Western, with headquarters at Durand, Mich., succeeding **J. Dodge**, who has been assigned to other duties. **H. F. Varblow** has been appointed supervisor, with headquarters at Durand, to succeed **Frank A. Tranzow**, whose promotion to superintendent of track, with headquarters at Detroit, Mich., was noted in the September issue.

Mr. Tranzow entered the service of the Chicago & Grand Trunk (now a part of the Grand Trunk Western) in October, 1899, as a section laborer at Port Huron, Mich. He was promoted to roadmaster with headquarters at Durand, Mich., on March 1, 1903, and on January 1, 1914, his title was changed to supervisor, which position he was holding at the time of his promotion to superintendent of track on August 1.

Bridge and Building

D. K. van Ingen, assistant engineer on the Chicago & North Western, with headquarters at Sioux City, has been promoted to supervisor of bridges and buildings, with headquarters at Mason City, Iowa, succeeding **C. Bach**, who has retired.

J. T. Diffey, pile driver foreman on the Missouri-Kansas-Texas, has been promoted to supervisor of bridges and buildings on the St. Louis district, with headquarters at Boonville, Mo., succeeding **O. O. Horton**, who has been appointed general foreman of the ballast-crushing plant at Sweeney, Mo.

Purchasing and Stores

Lambert N. Hopkins, purchasing agent of the Chicago, Burlington & Quincy, with headquarters at Chicago, has retired after a continuous service of 43 years with that company, during 23 years of which he was purchasing agent. **Joseph R. Haynes**, assistant purchasing agent, with headquarters at Chicago, has been promoted to purchasing agent to succeed Mr. Hopkins.

Obituary

John J. Cronin, roadmaster of the Bingham & Garfield, with headquarters at Magna, Utah, died on September 16.

Henry Ferguson, retired superintendent of track of the Southern Ontario division of the Canadian National, died at Toronto, Ont., on July 23. Mr. Ferguson entered the service of the Grand Trunk (now a part of the Canadian National) in 1873 as a telegraph operator at Wales, Ont., and in the following year entered the maintenance of way department. He was promoted to roadmaster, with headquarters at Lindsey, Ont., in 1885, and was promoted to general roadmaster, with headquarters at London, Ont., in 1897, later being transferred to Toronto. In 1913 he was promoted to superintendent of track, with headquarters in the same city, which position he was holding at the time of his retirement in 1926, after a continuous service of 53 years with the Canadian National and its predecessor.

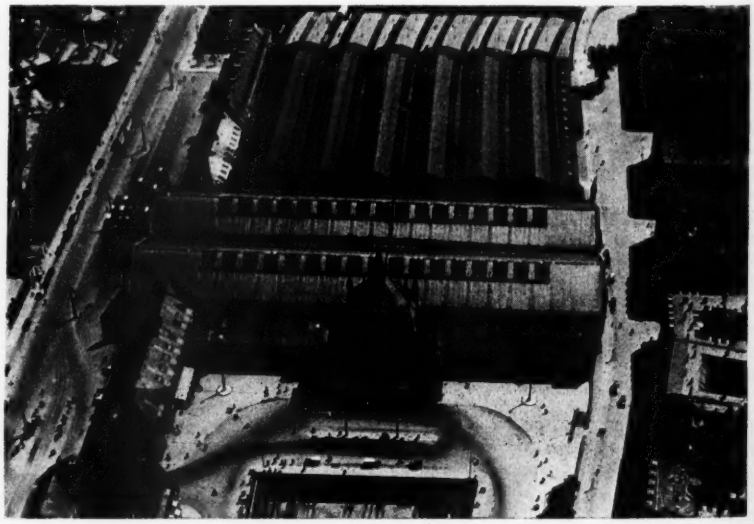
Ralph Hills Howard, chief engineer of the Wabash, with headquarters at St. Louis, Mo., died on September 20 at Petoskey, Mich., following a stroke of apoplexy. Mr. Howard was born on August 15, 1870, at Zanesville, Ohio,

Ralph Hills Howard

and after finishing his high school course, studied engineering under Edmund Turner, C. E. He entered railway service in October, 1889, as a draftsman on the Cincinnati & Muskingum Valley (now part of the Pennsylvania) and was promoted successively to assistant on the engineer corps, chief clerk to the engineer maintenance of way, and assistant engineer. In April, 1905, he was appointed principal assistant engineer in charge of construction and improvements on the Chicago & Eastern Illinois, and in October of the same year was promoted to engineer maintenance of way in charge of all maintenance and construction work. During the period from May, 1910, to January, 1911, he was engaged in special engineering work in connection with railroad properties for a group of eastern capitalists, following which he was appointed chief engineer of the Great Southern Lumber Company and engineer maintenance of way of the New Orleans Great Northern, with headquarters at Bogalusa, La. In June, 1911, he was promoted to general manager of that railroad, with headquarters at the same point. In May, 1915, Mr. Howard was appointed chief engineer maintenance of way of the Wabash, with headquarters at St. Louis and on October 1, 1925, he was promoted to chief engineer, with headquarters at the same point, which position he was holding at the time of his death.

Daniel O'Hern, roadmaster on the Elgin, Joliet & Eastern, with headquarters at Joliet, Ill., died on September 25, after a service of 24 years with that road. Mr. O'Hern was born on April 4, 1858, at Rutland, Vt., and entered the service of the E., J. & E. in 1904 as an extra gang foreman. He was promoted to roadmaster in 1908, and continued in that position until the time of his death.

William J. Bryson, formerly an assistant engineer on the Chicago & Alton, and later assistant to the president of that road, died at Lake Placid, N. Y., on September 16. Mr. Bryson was born on July 14, 1845, at New Rochelle, N. Y., and, after completing special courses in engineering, was engaged in government and municipal work from 1863 to 1898, when he entered railway service as an assistant engineer on the C. & A. Mr. Bryson was later promoted to assistant to the president, which position he was holding when he retired in 1900.



Central Station, Copenhagen, Denmark

Buyers' Guide

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Acetylene Dissolved
Oxweld Railroad Service Company

Air Compressors
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Generator Sets
Buda Co.

Air Hoists
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Lift Pumping Machinery
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Aluminum Numbers & Letters
Niagara Metal Stamping Corp.

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Ballast Spreaders
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Bank Builders
Jordan Co., O. F.

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Ballast Trimmers
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Bearings, Axle
Buda Co.
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Woolery Machine Co.

Bearings, Roller
Timken Roller Bearing Co.

Bearings, Tapered Roller; Thrust and Journal Box
Timken Roller Bearing Co.

Benders, Rail
See Rail Benders

Blowers, Turbo
Ingersoll-Rand Co.

Bolts
Bethlehem Steel Co.
Illinois Steel Co.
Louisville Frog & Switch Co.

Bonding Outfits, Rail
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Braces, Track
Coover Railroad Track Brace Co.
Louisville Frog & Switch Co.
Ramapo Ajax Corp.

Buckets
Industrial Brownhoist Corp.
Owen Bucket Co.

Buckets, Clam Shell
Industrial Brownhoist Corp.
Owen Bucket Co.

Building Beams, Concrete
Federal Cement Tile Co.
Massey Concrete Prod. Corp.

Building Papers
Lehon Co.

Bumping Posts
Buda Co.
Louisville Frog & Switch Co.
Mechanical Mfg. Co.

Calcium Carbide
Oxweld Railroad Service Co.

Car Replacers
American Chain Co., Inc.
Louisville Frog & Switch Co.

Cars, Ballast
See Ballast Cars

Cars, Dump
See Dump Cars

Cars, Hand
Buda Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.
Northwestern Motor Co.

Cars, Industrial
Koppel Industrial Car & Equip. Co.
Magor Car Corp.

Cars, Inspection
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Cars, Motor
Buda Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Cars, Section
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Car, Spreader
Jordan Co., O. F.

Car Stop, Friction
Maintenance Equipment Co.

Cars, Velocipede
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.

Castings
Bethlehem Steel Co.
Louisville Frog & Switch Co.
Timken Roller Bearing Co.
Wharton, Jr. & Co., Inc., Wm.

Catchbasins
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.

Cattle Guards
Kalamazoo Railway Supply Co.

Cattle Passes
Massey Concrete Products Corp.

Cement, Portland
Ash Grove Lime & Portland Cement Co.
Portland Cement Assn.

Cement Roofing Tile
Federal Cement Tile Co.

Cement Repair
Carey Co., Philip

Chemical Weed Killer
Chipman Chemical Engineering Co., Inc.

Clamshell Buckets
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Clips, Adjustable
Louisville Frog & Switch Co.
Ramapo Ajax Corp.

Coal Handling Machinery
Industrial Brownhoist Corp.
Northwest Engineering Co.

Compressors
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Compromise Joints
See Joints, Compromise

Concrete Roofing Tile
Federal Cement Tile Co.

Concrete Units, Miscellaneous
Federal Cement Tile Co.
Massey Concrete Prod. Corp.

Condensers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Corrosion Preventive
Dearborn Chemical Co.

Corrugated Iron
Armco Culvert Mfrs. Ass

Cranes, Barge, Electric Erecting, Gantry, Locomotive, Pillar, Transfer, Tunnel, Wharf and Wrecking
American Hoist & Derrick Co.
Buckeye Traction Ditcher Co.
Industrial Brownhoist Corp.
Northwest Engineering Co.

Creosoted Timber
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Cribbing, Concrete
Federal Cement Tile Co.
Massey Concrete Products Corp.

Crossing Gates
Buda Co.
Foote Bros. Gear & Machine Co.
Kalamazoo Railway Supply Co.

Crossings, Highway
Kentucky Rock Asphalt Co.
Ohio Valley Rock Asphalt Co.

Crossings, Rail
Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Culvert Pipe
American Castings Co.
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.
Massey Concrete Products Corp.
U. S. Cast Iron Pipe & Fdry. Co.

Culverts, Corrugated Metal
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.

Curbing
Massey Concrete Products Corp.

Cypress, Red
Southern Cypress Mfrs. Ass'n.

Derails
Q. & C. Co.
Wharton Jr. & Co., Wm.

Derailing Switches
Louisville Frog & Switch Co.
Ramapo Ajax Corp.

Derrick Cars
Maintenance Equipment Co.

Diesel Engines
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Diesel Electric Power Plants
Ingersoll-Rand Co.

Discing Machines
Fairmont Railway Motors, Inc.

Disinfectants
Chipman Chemical Engineering Co., Inc.

Ditchers
American Hoist & Derrick Co.
Buckeye Traction Ditcher Co.
Jordan Co., O. F.
Northwest Engineering Co.

Draglines
Northwest Engineering Co.

Drains, Perforated
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.

Drills, Earth
Buda Co.

Drills, Pneumatic
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Drills, Rock
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works

Drill Steel, Rock
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Drills, Track
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Kalamazoo Railway Supply Co.
Louisville Frog & Switch Co.

Drinking Fountains
Murdock Mfg. & Supply Co.

Dump Cars
Differential Steel Car Co.
Jordan Co., O. F.
Koppel Industrial Car & Equip. Co.
Magor Car Corp.

Electric Cranes (Locomotive, Pillar, Transfer & Wrecking)
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Electric Power Units
Electric Tamper & Equipment Co.
K. & W. Equipment Co.
Northwestern Motor Co.
Syntron Co.

Electric Snow Melters
Lundie Engineering Corp.
Q. & C. Co.

Engines, Gasoline
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Engines, Motor Car
Buda Co.
Fairmont Railway Motor Co.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Engines, Oil
Buda Co.
Chicago Pneumatic Tool Co.
Fairmont Railway Motors, Inc.
Ingersoll-Rand Co.

Excavators
American Hoist & Derrick Co.
Northwest Engineering Co.

Explosives
DuPont de Nemours & Co., Inc., E. I.

Fences
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
Page Fence Association
Q. & C. Co.

Fence, Fabric
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
Page Fence Association

Fence Posts
Anchor Post Fence Co.
Massey Concrete Products Corp
Maintenance Equipment Co.
Page Fence Association
Q. & C. Co.

Fibre Angle Pieces, Bushings, Etc.
Q. & C. Co.

Fibre Insulation
Q. & C. Co.

Flange Lubricator
Maintenance Equipment Co.

Flangers, Snow
Q. & C. Co.

Floor Coverings
Lehon Co.

Forgings
Bethlehem Steel Co.

Frogs
Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Inc., Wm.

Gages, Measuring
Lufkin Rule Co.

Gages, Pressure Gas
Oxweld Railroad Service Co.

Gas, Acetylene
Oxweld Railroad Service Co.

Gates, Drainage
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.

Grading Machinery
American Hoist & Derrick Co.

Graphite
Dixon Crucible Co., Jos.
U. S. Graphite Co.

Graphite Paint. See Paint, Graphite

Grease, Track
U. S. Graphite Co.

Grinders, Portable
Buda Co.
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Guard Rails
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Carnegie Steel Co
Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp
Wharton Jr. & Co., Wm.

Guard Rail Clamps
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Hammers, Chipping, Sealing and Calking
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Hammer Drills
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Hammers, Forge
Sullivan Machinery Co.

Hammers, Riveting
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Hand Car Bearings
Timken Roller Bearing Co.

Head Drains, Perforated
Central Alloy Steel Corp.

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Hoisting Machinery
Industrial Brownhoist Corp.
Ingersoll-Rand Co.

Hoists, Air Motor
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Hose
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

House Lining
Lehon Co.

Hydrants, Fire
Murdock Mfg. & Supply Co.

Hydrants, Self Closing
Murdock Mfg. & Supply Co.

Ice Cutters
Jordan Co., O. F.

Insection Cars
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Inspection, Engineering
Hunt Co., Robert W.

Insulated Rail Joints
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.

Insulating Material
Lehon Co.

Jacks, Bridge
Buda Co.
Kalamazoo Railway Supply Co.

Jacks, Track
Buda Co.
Hackmann Railway Supply Co.
Kalamazoo Railway Supply Co.
Verona Tool Works

Joints, Compromise
American Chain Co., Inc.
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.

Joint Fastenings
Illinois Steel Co.

Joints, Rail
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.
Wharton Jr. & Co., Wm.

Joints, Step
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.

BUYERS' GUIDE

Junction Boxes
Massey Concrete Products Corp.

Knuckles, Emergency
Q. & C. Co.

Liners, Track
Buda Co.
Hackmann Railway Supply Co.
Rail Joint Co.

Lock Washers
Louisville Frog & Switch Co.
National Lock Washer Co
Reliance Manufacturing Co.
Verona Tool Works

Locomotives, Oil Engine Electric Driven
Ingersoll-Rand Co.

Lubricants
Dixon Crucible Co., Jos.

Lumber
Southern Cypress Mfrs. Ass'n.

Manganese Track Work
Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Manholes
Massey Concrete Products Corp.

Markers
Massey Concrete Products Corp.

Mile Posts
Massey Concrete Products Corp.

Motor Bearings
Timken Roller Bearing Co.

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Fairmont Railway Motors, Inc.

Non-Derailer
Ramapo Ajax Corp.

Nut Locks
Louisville Frog & Switch Co.
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works
Woodings Forge & Tool Co.

Nuts
Bethlehem Steel Co.
Illinois Steel Co.
Louisville Frog & Switch Co.

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Out Houses
Massey Concrete Products Corp.

Oxygen
Oxweld Railroad Service Co.

Oxy-Acetylene Welding Equipment
Oxweld Railroad Service Co.

Paint
Dixon Crucible Co., Jos.
Semet-Solvay Co.
U. S. Graphite Co.

Paint, Graphite
Dixon Crucible Co.
Semet-Solvay Co.
U. S. Graphite Co.

Paint, Metal Protecting
Dixon Crucible Co., Jos.
Semet-Solvay Co.
U. S. Graphite Co.

Pavement Breakers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Pile Drivers
American Hoist & Derrick Co.
Ingersoll-Rand Co.
Industrial Brownhoist Corp.

Piling
Carnegie Steel Co.
Jennison-Wright Co.
Massey Concrete Products Corp.
Prettyman & Sons, J. F.

Pipe, Cast Iron
American Casting Co.
Central Foundry Co.
U. S. Cast Iron Pipe & Foundry Co.

Pipe Carriers
Massey Concrete Products Corp.

Pipe, Concrete
Massey Concrete Products Corp.

Pipe, Corrugated
Armco Culvert Mfrs. Assn.

Pipe Joint Compound
Dixon Crucible Co., Jos.

Pipe, Sewer
American Casting Co.
Armco Culvert Mfrs. Assn.
Central Foundry Co.
Massey Concrete Products Corp.

Plates, Miscellaneous
Louisville Frog & Switch Co.
Ramapo Ajax Corp.

Platforms, Station
Kentucky Rock Asphalt Co.
Ohio Valley Rock Asphalt Co.

Poles
Jennison-Wright Co.
Massey Concrete Products Corp.
Prettyman & Sons, J. F.

Posts, Fence
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Posts, Bumping
See Bumping Posts

Post Hole Diggers
Buda Co.

Powders
DuPont de Nemours & Co. Inc., E. I.

Power Plants, Portable
Electric Tamper & Equipment Co.
Northwestern Motor Co.
Syntron Co.

Preservation, Timber
Jennison-Wright Co.
Prettyman & Sons, J. F.

Products, Gas
Oxweld Railroad Service Co.

Pumps, Air Pressure & Vacuum, Centrifugal, Deep Well, Piston, Plunger, Rotary, Slump
American Well Works
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
United Iron Works, Inc.

Push Cars
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.

Push Car Bearings
Timken Roller Bearing Co

Rail Anchors
American Fork & Hoe Co.
Bethlehem Steel Co.
Coover Railroad Track Brace Co.
Louisville Frog & Switch Co.
Lundie Engineering Corp.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Rail Anti-Creepers
See Anti-Creepers, Rail

Rail Benders
American Chain Co., Inc.
Buda Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Verona Tool Works

Rail Bonds
Verona Tool Works

Rail Braces
Bethlehem Steel Co.
Buda Co.
Coover Railroad Track Brace Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr., & Co., Wm.

Rail Expanders
Ramapo Ajax Corp.

Rail Joint Shims
American Fork & Hoe Co.

Rail Joints
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Rail Layers
Buckeye Traction Ditcher Co.
K. & W. Equipment Co.
Maintenance Equipment Co.
Nordberg Mfg. Co.

Rail Saws, Portable
Industrial Brownhoist Corp.
Kalamazoo Railway Supply Co.
Q. & C. Co.

Rail Springs
Verona Tool Works

Rails, Girder
Bethlehem Steel Co.

Rails, Tee
Bethlehem Steel Co.
Carnegie Steel Co
Louisville Frog & Switch Co.

Regulators, Oxy-Acetylene
Oxweld Railroad Service Co.

Replacers, Car & Locomotive
American Chain Co., Inc.
Buda Co.
Q. & C. Co.

Retaining Walls, Precast
Federal Cement Tile Co.
Massey Concrete Product Corp.

Rivets
Bethlehem Steel Co.
Louisville Frog & Switch Co.

Rock Hammers
Ingersoll-Rand Company

Rods, Welding
Oxweld Railroad Service Co.

Roof Slabs
Federal Cement Tile Co.
Massey Concrete Products Corp.

Roofing, Cement & Concrete Tile
Federal Cement Tile Co.

Roofing Composition
Lehon Co.

Rules
Lufkin Rule Co.

Rust Preventive
Dearborn Chemical Co.

Safety Flags
Louisville Frog & Switch Co.

Saw Rigs
American Saw Mill Machinery Co.

Saws, High Speed Friction
American Saw Mill Machinery Co.

Saw Mills
American Saw Mill Machinery Co.

Scales, Tape
Lufkin Rule Co.

Scoops
Ames Shovel & Tool Co.

Screw Spikes
Illinois Steel Company

Screw Spike Drivers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Section Cars
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Sharpeners, Rock Drill Steel
Ingersoll-Rand Co.

Sheathing Paper
Lehon Co.

Sheet Iron
Armco Culvert Mfrs. Assn.

Shingles, Composition
Lehon Co.

Shovels
Ames Shovel & Tool Co.
Verona Tool Works
Woodings Forge & Tool Co.

Shovels, Steam
American Hoist & Derrick Co.
Northwest Engineering Co.

Signal Foundations, Concrete
Massey Concrete Products Corp.

Skid Excavators & Dredges
Northwest Engineering Co.

Skid Shoes
Q. & C. Co.

Slabs, Concrete
Massey Concrete Products Corp.

Smoke Stacks
Massey Concrete Products Corp.

Snow Melting Device
Lundie Engineering Corp.
Q. & C. Co.

Snow Plows
Jordan Co., O. F.
Q. & C. Co.

Spades
Ames Shovel & Tool Co.

Spikes
Bethlehem Steel Co.
Illinois Steel Company

Spike Pullers
Louisville Frog & Switch Co.

Spreader Cars
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Stands, Switch & Target
Bethlehem Steel Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp.

Steel, Alloy
Central Alloy Steel Corp.
Illinois Steel Company

Steel Cross Ties
Carnegie Steel Co.

Steel, Electric Furnace
Timken Roller Bearing Co.

Steel, Open Hearth
Timken Roller Bearing Co.

Steel Plates and Shapes
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Steel, Special Analysis
Timken Roller Bearing Co.

Step Joints
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Structural Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Switch Guard
Louisville Frog & Switch Co.
Ramapo Ajax Corp.

Switches
Bethlehem Steel Co
Buda Co.
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm

Switchmen's Houses
Massey Concrete Products Corp.

Switchpoint Protector
Fleming Co.
Maintenance Equipment Co.

Switchstands & Fixtures
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm

Tags, Aluminum
Niagara Metal Stamping Corp.

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Lufkin Rule Co.

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Telegraph Service, Long Distance
American Telephone & Telegraph Co.

Telephone Service, Long Distance
American Telephone and Telegraph Co.

Testing of Materials
Hunt Co., Robert W.

Thawing Outfits
Lundie Engineering Corp.
Q. & C. Co.

Ties
Jennison-Wright Co.
Prettyman & Sons, J. F.

Tie Plate Clamps
Q. & C. Co.

Tie Plates
Bethlehem Steel Co.
Illinois Steel Co.
Louisville Frog & Switch Co.
Lundie Engineering Corp.
Sellers Manufacturing Co.

Tie Rods
Bethlehem Steel Co
Louisville Frog & Switch Co.

Tie Scorer
Woolery Machine Co.

Tie Spacer
Maintenance Equipment Co.

Tie Tampers
Chicago Pneumatic Tool Co.
Electric Tamper & Equipment Co.
Ingersoll-Rand Co.
Syntron Co.

Tile, Roofing
Federal Cement Tile Co.

Timber
Southern Cypress Mfrs. Ass'n.

Timber, Creosoted
Jennison-Wright Co.
Prettyman & Sons, J. F.

Tools, Drainage
Ames Shovel & Tool Co.

Tools, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Tools, Pneumatic
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Tools, Track
Ames Shovel & Tool Co.
Buda Co.
Hackmann Railway Supply Co.
Maintenance Equipment Co.
Verona Tool Works
Woodings Forge & Tool Co.

Tongue Switches
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

Torches, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Track Braces
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Track Cranes
Buckeye Traction Ditcher Co.
K. & W. Equipment Co.
Nordberg Mfg. Co.

Track Drills
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Track Gages
Buda Co.
Kalamazoo Railway Supply Co.
Louisville Frog & Switch Co.

Track Insulation
Q. & C. Co.

Track Jacks
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Track Levels
Kalamazoo Railway Supply Co.

Track Liners
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Track, Special Work
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Wharton, Jr., & Co., Wm.

Track Tools
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Trestle Slabs
Massey Concrete Products Corp.

Trucks, Hand, Steel
Anchor Post Fence Co.

Tubing, Seamless Steel
Timken Roller Bearing Co.

Ventilators
Q. & C. Co.

Water Treating Plants
Dearborn Chemical Co.

Waterproofing Fabrics
Lehon Co.

Weed Burner
Fairmont Railway Motors, Inc.
Woolery Machine Co.

Weed Killer
Chipman Chemical Engineering Co., Inc.
Q. & C. Co.

Welding & Cutting Equipment
Electric Railweld Service Corp.
Oxweld Railroad Service Co.

Welding, Electric
Electric Railweld Service Corp.

Welding, Oxy-Acetylene
Oxweld Railroad Service Co.

Wheels, Hand & Motor Car
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Wheels, Wrought Steel
Carnegie Steel Co.

Wire Fencing
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
Page Fence Association

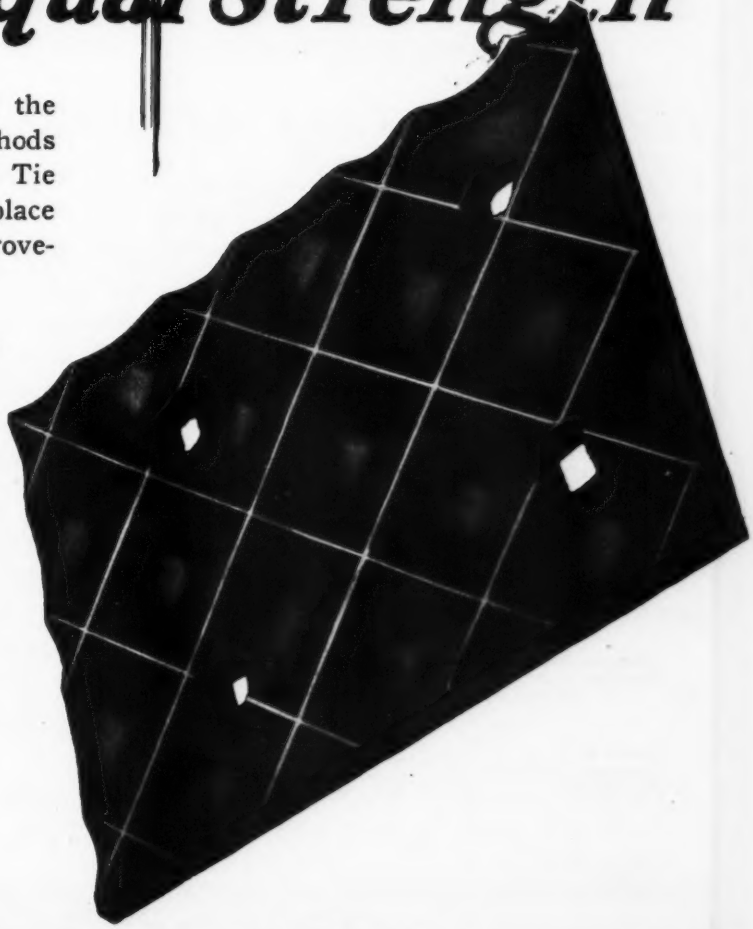
Wood Preservation
See Preservation, Timber

Wood Working Machinery
American Saw Mill Machinery Co.

10% Lighter—
with Equal Strength

For years we have improved the metal and manufacturing methods used in producing SELLERS Tie Plates, until we reached a place where but little further improvement could be made.

So we improved the design.



SELLERS
ARCHED BOTTOM
Wrought Iron
Tie Plates

are now recognized and acknowledged as the ideal in both material and design.

SELLERS MANUFACTURING COMPANY
ILLINOIS MERCHANTS BANK BLDG., CHICAGO, ILLINOIS

ALPHABETICAL INDEX TO ADVERTISERS

LEADERSHIP

Claims of leadership can be made, and often are made, without sufficient proof to justify them.

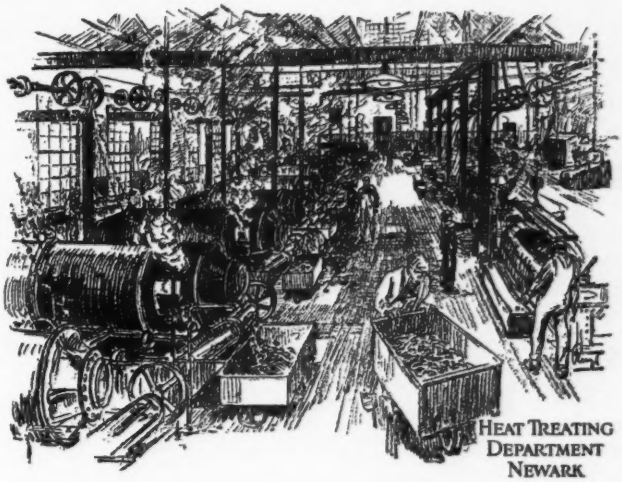
We believe that the following three facts are substantial evidence of real leadership.

First: The majority of the railroads of this country have adopted Improved Hipower.

Second: Most of the roads that try them use more each year.

Third: The number of roads using Improved Hipower is steadily increasing.

This leadership is due to the many points of Improved Hipower superiority which we are taking up one by one in our advertisements this year.



There are many points of Improved Hipower superiority. This is point of superiority No. 9.

PERFECTED HEAT TREATMENT

OUR heat treating methods are unique. We built a heat treating plant and developed, in continuous consultation with well-known metallurgists, an exact process that has never been approached in the making of spring washers. This precise treatment is absolutely essential. It alone enables us to give you Improved Hipower's exceptionally high reactive power. Less careful heat treating methods are ample for spring washers of lower reactive strength.

The perfecting of this process has helped to place us in a position of leadership. From our own rolling mills to the shipping room we control and inspect every step in the production of spring washers that are now accepted by railroads as the standard of quality.

There are many other points of superiority. Our advertisements will announce them.

THE NATIONAL LOCK WASHER COMPANY
Newark, New Jersey, U. S. A.

IMPROVED HIPOWER

Commercially Non-flattenable - - Permanently Rust-Proof